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Progress in Radiological Equipment

A VISITOR to last week's Radiological Exhibition (reviewed in this issue) seeking something new and revolutionary may have suffered some disappointment from a casual tour of the exhibits. Closer inspection and inquiry, however, would have brought to his attention many improvements in details.

At the same time, those who have installed new equipments during the last year or two must have felt some satisfaction that, apart from age, their plants have not descended very far down the scale of obsolescence.

The general impressions gained from this year's show are that steady progress is being made from the points of view of improving reliability, fineness of control, increase of efficiency, reduction in dimensions, and mechanical details. The cost of X-ray apparatus is very high compared with that of equipment in other fields of electrical industry. One can understand the reason for this from some aspects, considering the large amount of experimental and research work which has to be carried out for a comparatively small market. The developments which have taken place of recent years have resulted in costs which appear to mount higher and higher.

While this may be considered the price of progress, it results in increasing strain on the finances of the buyers, especially the voluntary hospitals. The result of this is a tendency to install the minimum amount of apparatus and attempt to apply it to the maximum number of requirements, a practice which cannot be recommended from many points of view.

Nowadays it is often stated that the time is rapidly approaching, if it is not already here, when the private radiologist will not be able to afford to provide his own installation, and there is no disputing the fact that many promising young medical men hesitate to enter this field on account of the difficulties of getting set up with an efficient equipment.

On the other hand, one never hears of an X-ray manufacturer who has made his fortune, or anything approaching it. There is no doubt that much could be accomplished by closer co-operation in the industry, by the pooling of ideas, and by greater specialisation. It is now some long time since a moderate degree of stabilisation was reached and the buyers are entitled to look forward to some easing of the burden of high installation costs.

There is one other aspect in connection with this which should not be overlooked. It often happens that when a manufacturer installs a new equipment, and eventually gets paid for it, the buyer appears to expect that he should have it maintained, trouble free, for an indefinite period. In some cases, he is not even prepared to give it the attention that any and every piece of working equipment should receive.

It is obvious that this has to be paid for by somebody, and it would be to the advantage of all concerned if the manufacturer were given an agreed annual sum to make periodical service visits in order to maintain the apparatus in clean and efficient working order. Servicing a modern X-ray equipment is quite beyond the capabilities of the average hospital employé or the private user.

The Radiological Exhibition was naturally limited in its scope and could provide no material indication of the remarkable developments that have taken place in the field in which X-rays have the widest human appeal—the treatment of cancer. For this we must look to such equipment as that to be found in the Mozelle Sassoon high-voltage X-ray department of St. Bartholomew's Hospital which was opened yesterday (Thursday).

This installation is designed to give a beam of X-rays of greater penetrative power, higher intensity and shorter wave-length than any yet constructed for the purpose, and with a maximum voltage of 1,000 kV it puts us ahead of other countries.

The ease with which they can be controlled gives X-rays an initial advantage over radium. Possibly some years of research may be necessary, however, before a full store of knowledge of the physical, chemical and biological effects of high-voltage X-rays can be acquired, but eminent authorities believe that anticipations as to the benefits that will accrue to mankind from this application of electricity are firmly grounded.

Power-station Efficiencies

Two things that a station engineer ought to know about his plant are whether its efficiency is consistently maintained from week to week on every shift and how its performance, as a whole, compares with that of other stations, allowing for a difference in steam conditions and other operating factors. In his E.P.E.A. lecture, Mr. W. N. C. Clinch showed the value of Parsons lines for securing the first requirement and referred to Mr. W. F. Burge's I.E.E. paper of three years ago for the second. During the discussion the question was raised as to difficulties in applying Parsons lines to present-day inter-connected stations. This useful method of comparison envisaged outputs that varied only with seasonal changes of load, thus enabling deficiencies from "bogey" to be quickly observed, but not the transfer of load from one station to another in emergency or in the interests of the efficiency of the stations as a whole. We have no doubt that charge engineers would welcome suggestions as to means of watching for preventable losses in such circumstances.

A Practical Paper

THOSE of us who think at times that papers presented before the Institution of Electrical Engineers are not always sufficiently practical in character cannot complain about Mr. Holttum's I.E.E. Transmission Section paper on high-voltage cable jointing with which we deal this week. It is essentially a practical man's paper, of value to all engaged in distribution, not excluding the modern jointer, and it will be a pity if it is not allowed to benefit in the same way a wider circle of the industry. Apart from its value as a record of modern practice, there are two special reasons why the practical man should feel the influence of such a work. They are both expressed in the introduction—basic principles of jointing are the same for all h.v. cables, including oil- and gas-pressure types, and the problem of jointing consists of maintaining at the joint the essential characteristics of the cable in the most economical manner possible. A proper appreciation of such fundamental considerations is essential to progress.

Electricity and Acoustics

THE minimising of the noise caused by electrical machinery may have an important bearing on its extended use in many cases. In the new Fulham power-station the design of the electrical plant was especially directed to this end, which it is often just as necessary to achieve in sub-stations in residential areas and in certain applications of electricity. Yet, because the investigations are out of the ordinary run of electrical technology, there is a risk of their being overlooked. Scientific measurement of noise must be reconciled with the average listener's impressions as was done in an I.E.E. paper in March, 1934. One of the authors, Mr. H. Davies, has now prepared a monograph on "Noise Problems" for the Association of Engineering and Shipbuilding Draughtsmen which should be of service to electrical designers. As in so many analogous cases, the purely engineering values of noise count for less than does their effect on the public at large.

Fire Risks

THE earliest wiring regulations of the Institution of Electrical Engineers were drawn up mainly with a view to the prevention of fire. In successive editions the emphasis has come to be placed more and more on reducing the risk of shock. In his presidential address to the I.E.E. Mr. H. T. Young showed how few were the fatal accidents due to electricity compared with those arising out of every-day occurrences. Data sent us by Col. C. S. Lyon show that over 11 per cent. of the fires attended by the Liverpool Salvage Corps last year were due to electrical defects, which came third in the list of the main causes. Although the two sets of figures are not strictly comparable, since those relating to fires have no reference to fatalities, it is well to be reminded at this season of the year, when temporary wiring comes into use (some of it of a cheap and nasty variety), that the risk of fire is probably greater than the risk of shock.

Cleaned Coal

IN seeking to minimise grit emissions from chimneys, more attention has been paid to controlling combustion conditions than to reducing the ash content of the coal. The importance of the latter was emphasised during the conference of local authorities and other bodies co-operating with the Department of Scientific and Industrial Research which was held at the Greenwich Fuel Research Station recently. That it is better to get rid of the ash at the source than to pay the freight charges on its carriage from the colliery to the generating-station receives confirmation from a paper read by Mr. R. G. Evans before the Institute of Fuel on the operation of a plant with a capacity of 140 tons per hour. The cost per ton is given at 6d., of which electricity taken at 1d. per kWh accounts for 1.46d., and 267 h.p. of motors is installed, almost all in continuous operation. While circumstances vary greatly from pit to pit, these figures provide an indication of the value of the electrical load thus provided.

Adequate Installations Essential

ONE of the sections of the October "Building Industries Survey" published by the Building Industries National Council is devoted to the influence of building on the electrical industry. In this the relative importance of the domestic and industrial loads is considered. It notes that in the erection of new houses and the reconditioning of old ones in areas in which a supply of electricity is available the buildings are wired for electricity almost without exception. The Council emphasises the fact that the demand of the domestic consumer depends to a much greater extent on the provision of electrically equipped buildings than the industrial demand, which depends largely on progress made in the electrification of industrial processes. It is well to have this stressed as a means of persuading those responsible to ensure adequate installations at the start. Electric lighting is considered essential nowadays, but if the installation provides for lighting alone other agents will become established in new houses, and, once there, they will want a lot of moving.

Princely Munificence

A FEW months ago we reported that Mr. Frank Parkinson, chairman of Crompton Parkinson, Ltd., had given £50,000 to establish a scholarship fund at Leeds University, of which he was once a student. Mr. Parkinson has now followed this up with a gift of £200,000 to the University for the specific purpose of providing a new frontage for the buildings, which are being reconstructed. In accepting this magnificent gift the University Council says that it will bring about the achievement of an ambition which might not have been realised within the lifetime of the present generation. Such munificence as this reflects great honour not only upon the donor but upon one of the country's greatest industries, of which he is a leader.

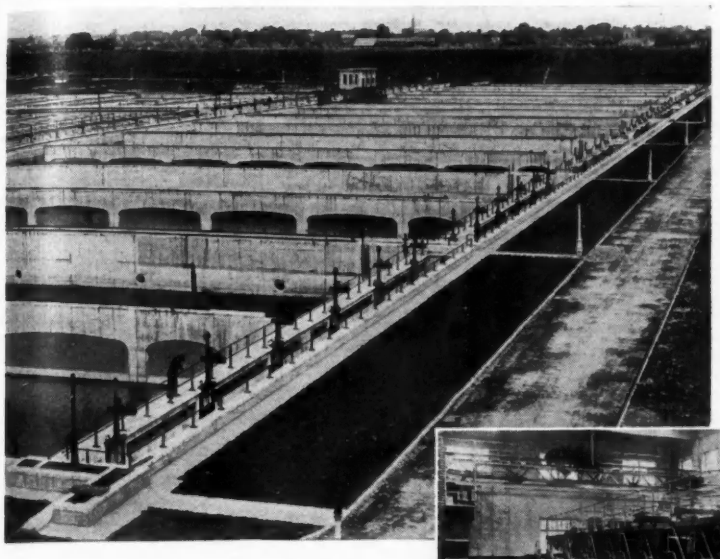
Round and Flat Pins

IN announcing its latest a.c. switching developments (mentioned on page 824 of this issue), an accessories manufacturing company refers to I.E.E. Regulation No. 1,329B as calling for only round-pin plugs and sockets, because it stipulates that every socket outlet and plug shall conform to the appropriate British Standard Specification and there is no such Specification for flat-pin plugs and sockets. This is correct if, in making the stipulation, the I.E.E. deliberately intended to rule out equipment which is presumably not covered by the existing Specification. It would allay some doubts if the Institution of Electrical Engineers and the British Standards Institution officially and publicly made these points clear.

West Middlesex Sewage Scheme

Electricity produced as a by-product for pumping and power

LONDON'S continued encroachment on the Home Counties is creating a serious sewage disposal problem. The rapid rate at which local authority areas are being built up is making it impossible to secure adequate sites for independent disposal plants, and it has become evident that co-ordinated regional concentration schemes of drainage will be needed.



Left: Storm-water tanks with penstock valves operated by 96 weatherproof motors. Right: Main sewage pumping station. 48/160-h.p. motors with starter panels

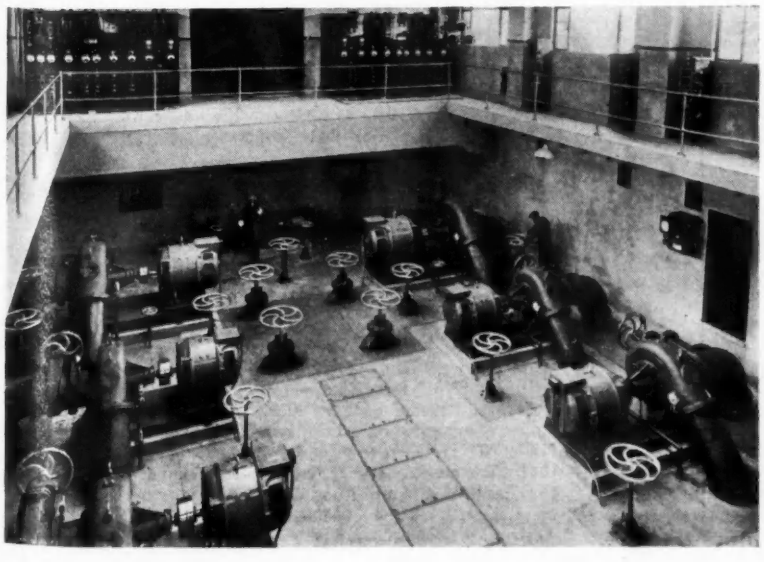
The first of these, for West Middlesex, has taken the County Council seven years to complete. The major portion is now in operation, while the "1940 extension" has already begun. The scheme is designed to serve a population of 1,075,000, ultimately two millions, in an area of 160 square miles. It embraces sixteen local authority districts and twenty-eight separate sewage works have been superseded.

The constructional work occupied five years and was divided into 36 contracts. The total expenditure is expected to be £5.5 millions, the purification works accounting for about one-third, while 70 miles of sewers ranging from 1 ft. 9 in. to 12 ft. 9 in. in diameter have cost £3,150,000.

The new works are at Mogden (on the site of the old Isleworth works), close to the River Thames. They are designed for a maximum wet weather flow of 575 million gallons per day, or 240 g.p.d. per head of population. About 75 per cent. of this volume is conveyed by gravitation through high level sewers from the northern parts of the area. The remainder is derived from the southern section by low level gravitation to a pump well, whence it is lifted 50 ft. to join the high level inflow to the screens. These remove solid matter, which is disintegrated and re-screened. Next grit is extracted and washed for sale to agriculturists. The liquor passes through sedimentation tanks and is then activated by diffusing air through it. From the final separation tanks the clear effluent is discharged into the Thames, while the sludge is thickened for primary bacterial digestion. It is then pumped seven miles westward to the disposal works at Perry Oaks, where it undergoes secondary digestion and is dried for disposal as manure.

The sewage inflow contains 50 parts of polluting matter to 100,000 parts of water, from which over 600,000 tons of sludge will be produced per annum. Its bacterial digestion will produce daily 800,000 cu. ft. of methane gas to be consumed by engines developing 50,000 h.p.-hours daily.

These Harland and Wolff Diesel-type engines, which are quickly convertible to oil fuel in emergency, are used to drive six Fraser & Chalmers (G.E.C.) turbo blowers of 15,000 cu. ft. per minute each used for aeration process. They are driven through speed increasing gears (Power Plant Co.) and Vulcan-Sinclair hydraulic couplings. Similar engines drive the electric generators (Lancashire Dynamo & Crypto, Ltd.) of which there are four 450-kW and one 175-kW, 300-r.p.m., compound wound sets producing d.c. at 460 V. The smallest is an oil-engined stand-by set, and there are two 230 V, 500 A, mid-wire rotary balancer sets, 750 r.p.m., compound wound type.



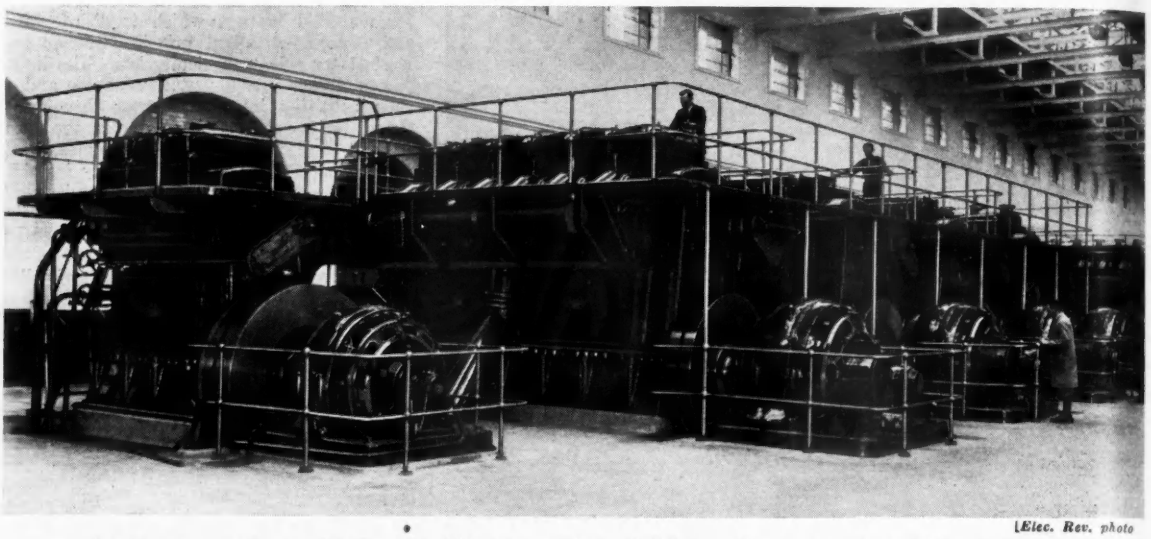
Return sludge pump-house with switchgear on galleries

The electrical equivalent of the present power and compressor house is 15 million kWh per annum. The saving in annual charges expected from this installation, after allowing for loan charges, is estimated to be at least £20,000. The electrical output has already reached 10,000 kWh per day. It is transmitted from an 18-panel switchboard in the power house to similar 18-panel and smaller boards (Whipp and Bourne and Erskine Heap) in the several pump houses, whence the

power is distributed to the surrounding points of application.

So far more than 300 motors have been installed, ranging in size from 0.25 to 160 b.h.p., mostly for variable-speed duty, hence the use of d.c. The majority are of Lancashire Dynamo and Crypto construction with Brookhirst starters, though a number for the screening plant were supplied by Laurence, Scott & Electromotors, Ltd.

The largest motors are in the main pump house, which has a capacity equivalent to 200 million gallons per day, requiring



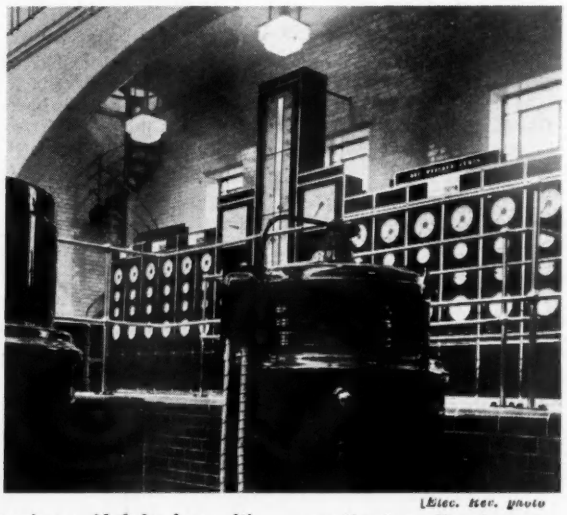
[*Elec. Rev.* photo

Section of power-house showing one 250-b.h.p. and four 550-b.h.p. methane-gas engines driving generators

3,960 b.h.p. There are twelve Worthington-Simpson vertical-spindle centrifugal pumps, six of which are of 5,000 g.p.m. capacity for lifting the low-level sewage 50 ft., each driven by a Lancashire Dynamo motor of 160 b.h.p. at 440 V and 675-895 r.p.m. The other six are for storm-water duty, each of 18,000 g.p.m. and driven by a Diesel oil engine of 500 b.h.p.

In the return sludge pump house, which is below ground with the control panels on a gallery above, 440-V Lancashire Dynamo motors are coupled horizontally to Worthington-Simpson centrifugal pumps, comprising one set of 6.5 h.p., two of 1.75-7 h.p., four of 1.75-13 h.p. and two of 5-39 h.p. Other motor-driven pumps are of Gwynnes' make and thick sludge reciprocators by M. B. Wild & Co., of 58-30 h.p. at 440 V and 960-320 r.p.m.

The penstocks of the storm-water tanks are actuated by ninety-six 2-h.p. motors. These with their starters and the motors driving the sludge scraping, collecting and stirring mechanisms in the various processing tanks, of which there is a large number, are weather proof and fully exposed to the elements above the open tanks. The semi-underground digestion tanks are enclosed within high earth



[*Elec. Rev.* photo

A nearer view of the main sewage control board

banks, while the motors and controllers (by the Electrical Apparatus Co. in this case) in this area are all of flameproof construction.

Liquor flow-measuring and process-metering equipment is of Lea, Kent & Electroflo manufacture. Centralised indicating, recording and integrating is provided for by multi-panel instrument boards in the pump houses, according to an Electroflo system employing large electrically operated venturi and flume meters. These establish circuit currents which are at all times proportional to the fluid flow, rising to 1 A at 40 V maximum. The summation recorders have been specially designed and are power driven. They dispense with relays in favour of a special type of thermionic valve null detector which functions without inertia or overshooting.

A commutator mechanically coupled to the pen causes current (entirely separate from that passing through the meter body) to vary with the pen position and be proportional to the chart reading at any pen position. Resistances connected to the commutator segments are so graded as to keep the current in the recorder circuit always proportional to the flow reading of the recorder. Any difference between this current and that from the several meter bodies is detected by the thermionic valve device (through an intermediary motor mechanically coupled to the recorder pen). This changes the pen position, correspondingly altering the recorder current.

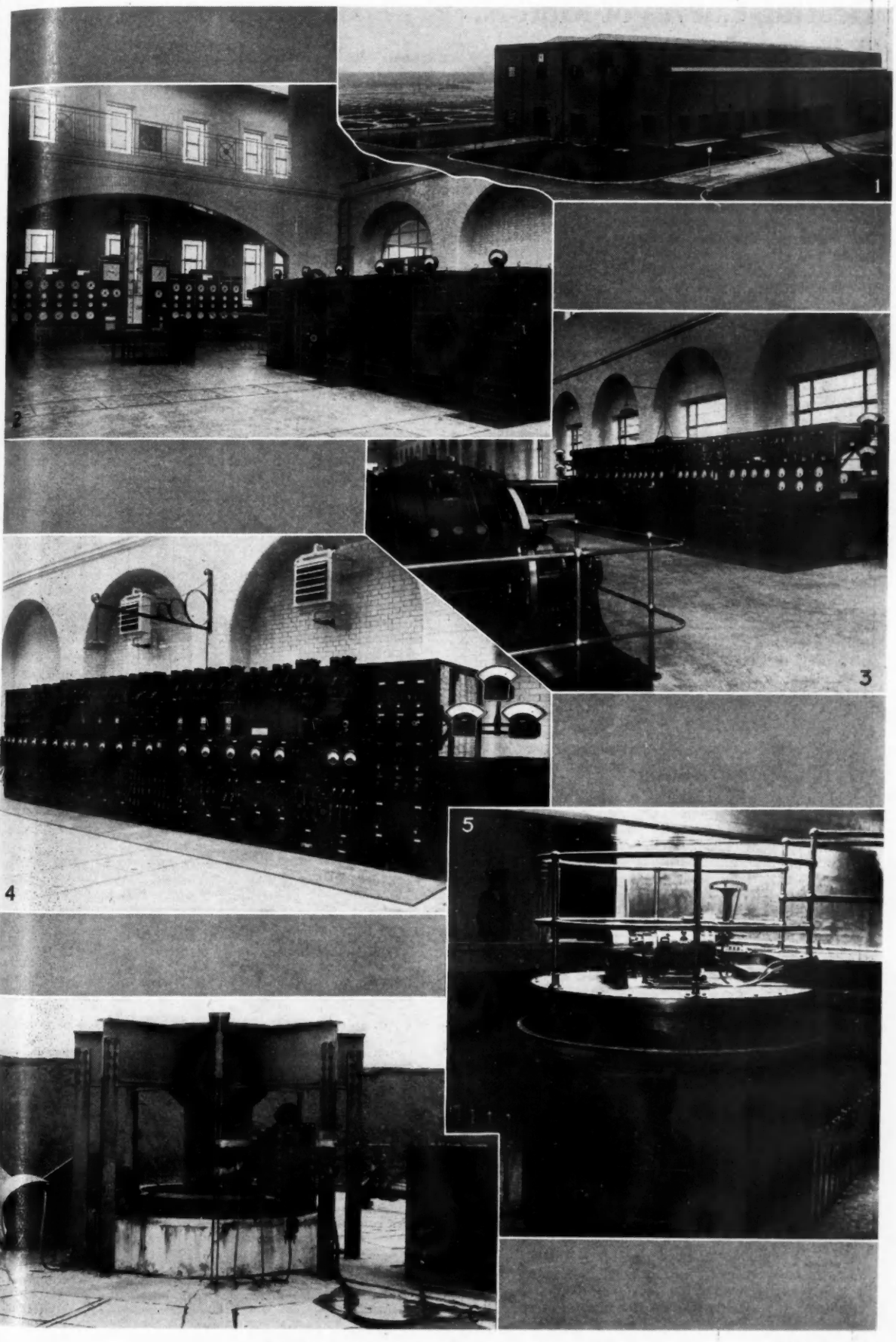
Standard high speed continuous flow rate integrators have also been modified to form totalising conductance meters. The flush panel instruments include illuminated priming level indicators, signal lamps, lever switches by which instructions are transmitted and an electrically operated static head indicator.

Pump outflow is regulated according to purification requirements by a penstock. This can be adjusted manually or automatically by electrical contacts in appropriately devised Electroflo metering circuits; penstock closure causing upstream weir overflow into the storm-water tanks. Electrical venturi flume meters have also been specially developed to satisfy the purification plant conditions. The metering is operated by a.c. from duplicate Lancashire Dynamo motor-generator sets.

"Detailed" purification tank flows are measured by Kent venturi meters with pedestal type electrical indicators on site beside each control valve. Similarly, electrical pedestal dials register the volume of air passing to the aeration tanks, and sludge venturi meters are fitted with transmitters and receivers.

Cables were supplied by W. T. Henley's Telegraph Works Co., Ltd., and other suppliers of electrical equipment included J. B. Marr & Co., Ltd., Electrical Installations, Ltd., and the City Electrical Co., Ltd. Sanders "Superior" switch and fuse gear is used for distribution in the underground valve and pipe galleries. Three complete installations of Gent's "Pulsynetic" clocks have been installed. Each is operated by a standard master clock and each has a small trickle-charger battery. Special impulse dials were supplied to the architect's specification. Vaughan cranes are employed, while there is an electrically equipped maintenance workshop. Indoor lighting is on conventional lines; essential outdoor standards are switched direct from the main control board, others having local weatherproof push switches.

The administration of the scheme has been undertaken by Major W. H. Morgan, County Engineer and Surveyor. Mr. C. B. Townend is the engineer-in-charge and Mr. W. Parker the mechanical and electrical engineer; both were formerly on the staff of the consultants, Messrs. J. D. and D. M. Watson, of Westminster.



The New Drainage Plant at Isleworth

[*Elec. Rev. photos.*

1. The power house containing d.c. generators and turbo-blowers. 2. Main pump house and sewage control board and (right) 160-h.p. pump motor starters. 3. Main 18-panel control switchboard in the power house. 4. The 18-panel distribution board in the main pump house. 5. Sludge-thickening tank showing motor-driven stirrer gear. 6. Top of a sludge digestion tank with flameproof motor and starter

Heating Curves of Motors.

By J. E. MacFarlane, B.Sc.(Eng.), A.M.I.E.E.

Investigations in relation to fractional horse-power machines

THE losses in electrical machines are transformed into heat which is dissipated to the surrounding atmosphere and the temperature of a motor reaches a steady figure when the heat dissipated equals the heat generated; with electrical machines cooling is effected by a combination of conduction and convection. The heat is generated mostly near the air-gap and transferred by conduction through the iron until it reaches surfaces in contact with the ventilating air and is so carried away in the air-stream. There is also some radiation from the outside carcase of the motor, but this applies more to small machines of the totally enclosed type.

The rate at which heat is dissipated depends upon θ, the difference between the temperature of the motor and that of the surrounding medium. In a small interval of time " dt " the temperature rise is " $d\theta$." The " d " in these expressions means that we are considering a very small amount of the quantity concerned. The heat generated during this time is P.dt. gramme-calories, where P is 0.24 times the watts loss (W). The heat absorbed during this time is G.s.$d\theta$ gramme-calories, where " G " is the weight of the material in grammes and " s " its specific heat. For a mixture of iron, copper and insulation the specific heat can be taken as 0.1, whilst for aluminium it is 0.212.

Equation for the Curve

The heat dissipated depends upon the radiating surface (A) and the rotor peripheral velocity (V), and a simple law of the form A(a+bV) is assumed. The heat dissipated during this time is A(a+bV)θdt gramme-calories. As the heat generated equals the heat dissipated, plus the heat absorbed by the motor, we can combine these three expressions in one equation: P.dt. = A(a+bV)θdt + G.s.$d\theta$.

The motor will reach a condition of steady temperature when no further heat is absorbed to raise its temperature, and this gives the maximum temperature rise θ_m, when the last term of the above equation disappears. From this equation it can be shown mathematically that the heating curve has an equation:

$$\theta = \theta_m (1 - e^{-\frac{t}{T}})$$

Where θ is the temperature rise at time t, θ_m is the maximum temperature rise, e=2.7183 and T is the heating time constant.

The curve of this equation is shown in fig. 1, where the percentage of the maximum temperature rise (θ_m) is plotted against the time t scaled in terms of the heating time constant T. From this it is seen that the time constant T occurs when the machine reaches 63.2 per cent. of its maximum temperature rise. T is given by the tangent at the origin.

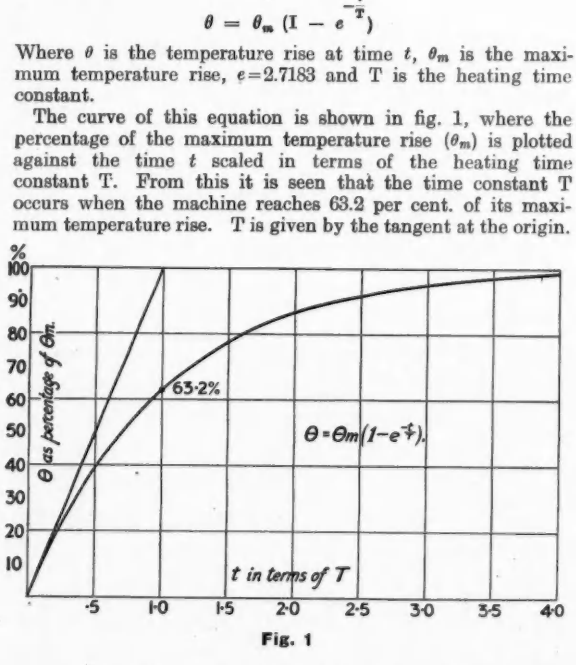


Fig. 1

Now, it can be shown that T=G.s.θ_m/P. With a given maximum temperature rise and knowledge of the material and losses in the motor the time constant can be found. The curve is fairly steep up to this point and flattens out over a longer period before the maximum temperature rise is attained. Advantage is taken of this in saving time and power consumption on motor testing by running a short-time test and estimating the final temperature rise from the heating curve.

The following temperature-test results on a fractional horse-power motor will illustrate this. Fig. 2 gives the heating curve which was continued until a steady temperature was reached. The motor losses were 192 W and the maximum temperature rise was 31 deg. C. The machine consisted of 908 grammes of active material and 1,320 grammes of aluminium. As there is a large proportion of aluminium the two specific heats are used.

Thus

$$T = \frac{[(908 \times 0.1) + (1320 \times 0.212)] \times 31}{(0.24 \times 192)} = 250 \text{ seconds} = 4.17 \text{ minutes.}$$

From the curve in fig. 2, in 4.17 minutes the temperature rise was 19.5 deg. C., which is 63 per cent. of the final temperature rise of 31 deg. C. and shows agreement with the calculated figure.

The following method is applicable to a short-time test when θ_m is unknown. Considering two equal intervals of time from the start, namely, 1 and 2, with temperature rises of θ_1 and θ_2 respectively, we get:

$$\theta_1 = \theta_m(1 - e^{-\frac{1}{T}}) \text{ and } \theta_2 = \theta_m(1 - e^{-\frac{2}{T}})$$

$$\therefore \frac{\theta_2}{\theta_1} = \frac{1 - K^2}{1 - K} = 1 + K, \text{ where } K = e^{-\frac{1}{T}}$$

$$\therefore e^{-\frac{1}{T}} = \frac{\theta_2}{\theta_1} - 1$$

From tables of the values of e^{-x}, or by logarithms, the value of the index of e can be found, and thus the time constant T. Referring again to fig. 2, and taking two equal intervals of ten minutes, the respective temperature rises are 26.3 deg. C. and 29 deg. C., hence 29/26.3 − 1 = 0.1 = e^{-x}. When e^{-x} is 0.1, then x is 2.3, and the time constant T is its reciprocal multiplied by the time interval chosen. ∴ T = 1/2.3 × 10 = 4.35 minutes. This is in fair agreement with the previous values.

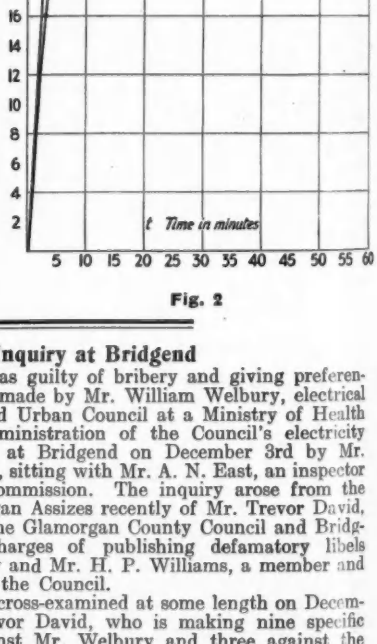


Fig. 2

Inquiry at Bridgend

Denials that he was guilty of bribery and giving preferential treatment were made by Mr. William Welbury, electrical engineer to Bridgend Urban Council at a Ministry of Health inquiry into the administration of the Council's electricity undertaking opened at Bridgend on December 3rd by Mr. H. L. Murphy, K.C., sitting with Mr. A. N. East, an inspector of the Electricity Commission. The inquiry arose from the acquittal at Glamorgan Assizes recently of Mr. Trevor David, former member of the Glamorgan County Council and Bridgend Council, on charges of publishing defamatory libels against Mr. Welbury and Mr. H. P. Williams, a member and former chairman of the Council.

Mr. Welbury was cross-examined at some length on December 4th by Mr. Trevor David, who is making nine specific allegations, six against Mr. Welbury and three against the Council. Mr. Welbury said it was not true that he accepted a bribe from a local contractor in connection with a tender for an electrical exhibition at Bridgend in 1931. He did not receive a case of wine as a gift from the contractor, but gave the contractor money to buy the wines, which were for the use of himself and his friends at the exhibition. Mr. Welbury also denied that he gave special low terms in connection with the installation of electricity at the house of Mr. G. Burgess, a Bridgend electrician, because he was friendly with him. He said the Council had passed a resolution to allow the special terms because Mr. Burgess's house had an all-in electricity system. It was not correct that he was financially interested in Mr. Burgess's business.

Adjourning the inquiry on Saturday last until December 29th, Mr. Lawson Murphy said that he was not prepared to allow further public expenditure on a "roaming inquiry into perfectly vague accusations," although he was willing to include further charges provided Mr. Trevor David furnished particulars to the Ministry of Health within seven days.

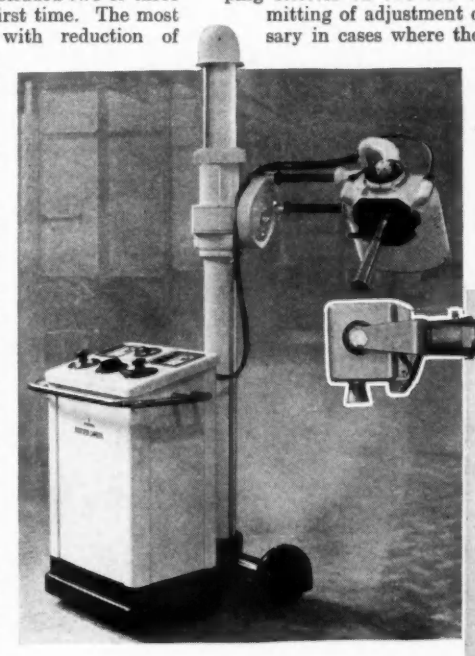
The Radiological Exhibition. By C. Morgan Davies, A.M.I.E.E.

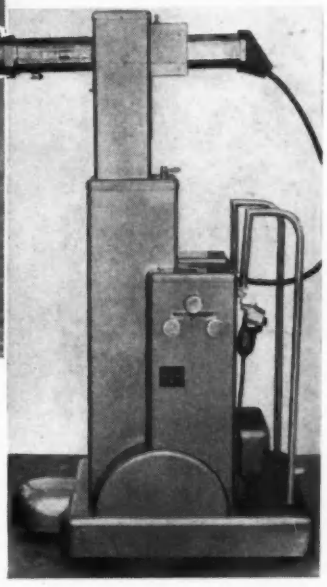
Many detail improvements

THE exhibition of apparatus arranged in conjunction with the tenth congress of the British Institute of Radiology was held at the Central Hall, Westminster, from December 2nd to 4th. The exhibits were representative of modern equipment and included two or three designs which were being shown for the first time. The most noticeable improvements are associated with reduction of weight and bulk relative to electrical output; the development of switching and selector arrangements; the stabilisation of electrical factors; and arrangements designed to protect the X-ray tube from damage consequent upon overloading and incorrect sequence of operations.

Apart from problems associated with insulation of high-voltage circuits and the accurate measurement of radiation, both being mainly concerned with therapy, the diagnostic unit undoubtedly provides the greater number of conundrums for the manufacturer. If we omit non-electrical factors for the moment, assuming them to be constant and satisfactory, the production of films of high diagnostic value and consistent in quality is dependent upon the following: (1) Selection of an X-ray tube having the smallest focal area consistent with the load to be applied in any particular case. (2) Facilities for accurate pre-determination and measurement of the penetration factor (kV applied to excite the tube), the quantity factor (mA-secs. for the exposure), and sufficient stability to ensure that, when the exposure occurs, the tube will be safely loaded as expected. If these conditions are satisfactory within the limits of tolerance permissible, these being governed mainly by the sensitivity of the emulsion on the film, the operator is relieved of much guesswork and left comparatively free to grapple with the final variable which cannot be standardised—the patient. The chief bugbear is variation of main supply pressure, sometimes occurring over a period of hours or from day to day, in other cases fluctuating from minute to minute. It may also be added that the size of the service should be adequate to meet the maximum demand made by the apparatus, without excessive voltage drop.

The measurement of tube voltage, governing the penetration, is always carried out indirectly on diagnostic units by means of a moving iron voltmeter connected in the primary circuit of the h.v. transformer. Where the latter is supplied from an auto-transformer, the instrument is connected directly across the tapping selectors, but where systems employing tappings on the primary of the h.v. transformer or/and inductive regulators are used, the instrument is usually connected to a measuring resistance or phantom transformer operated by the control gear. This voltmeter has necessarily to be used in conjunction with a calibration chart showing the discrepancies between its readings and the actual voltages which are applied to the tube when different outputs are taken from the transformer, most manufacturers calibrating the instrument to read secondary kVp. at no load. In order that the readings may not vary from their normal value consequent upon supply variations, some manufacturers provide a "mains voltage adjuster" consisting of a tapping selector on one end of the auto-transformer, thus permitting of adjustment of the ratio. This is hardly necessary in cases where the steps of kilovoltage selection are finely graded. Where the time factor is concerned, the majority of time switches now fitted can be maintained accurate with very little trouble by occasionally checking the impulses of radiation from the tube, photographically, and making any slight adjustments found necessary. The units exhibited employed either the synchronous motor-driven, condenser charge or discharge period, or gravity type of time switch. The inexpensive spring-driven type of timer is still employed on the miniature units.



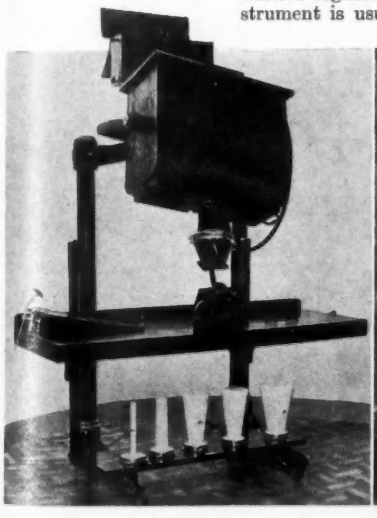


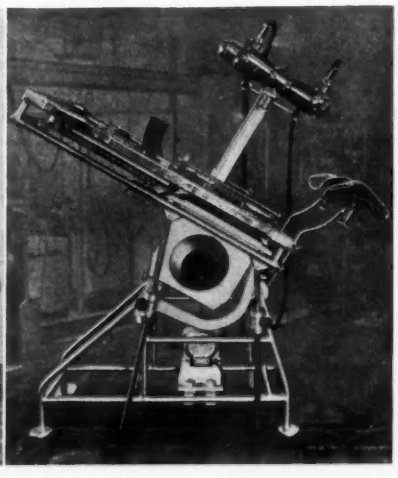
Left: Siemens Röntgen camera (G.R.S.A., Ltd.). Below: A "Diadex" mobile X-ray unit

[Elec. Rev. photo

It has long been recognised that it is impossible to measure the X-ray tube current by means of the ordinary milliammeter where fractional-second exposures are involved; consequently all units having outputs of approximately 200 mA upwards at radiographic voltages (30 to 100 kVp.) are fitted with milliampere-second meters. These may be either of the ballistic or quantic type of instrument, being in all cases connected to form the junction between the inner ends of the halves of the secondary winding of the h.v. transformer, operating at earth potential.

Much has been done to stabilise the heating conditions on the filaments of rectifying valves and X-ray tubes by the application of static stabilisers and compensating transformers connected in the primary circuits of the apparatus.





Left: The "Maximar" oil-immersed deep-therapy equipment. Right: A "Solus" motor-driven X-ray and examination couch

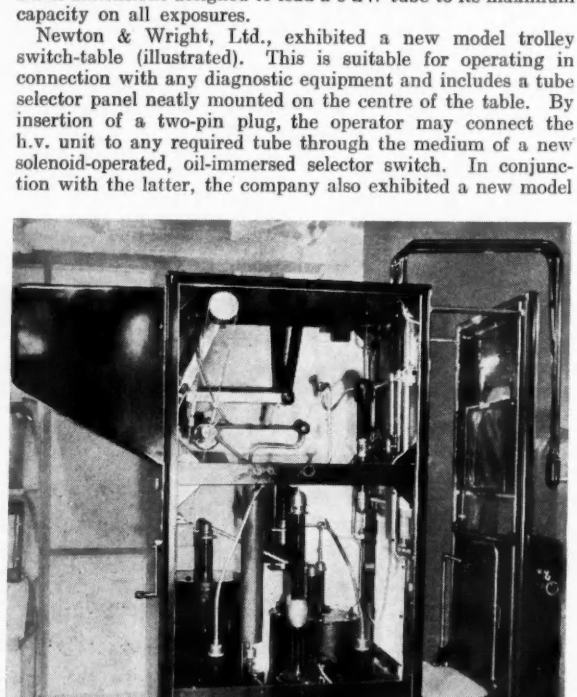
[Elec. Rev. photo

High and Medium Power Diagnostic Units

Many of the manufacturers exhibited units within this range. The largest was that seen on the stand of Watson & Sons (Electro-Medical), Ltd., and is known as the "Super D." This apparatus is a development of the "Quatralix" described briefly in these columns (December 15th, 1933), being much improved in detail. The maximum current obtainable is now 1,000 mA and the maximum voltage 110 kVp. Although the available output has been much increased, the dimensions of the complete unit do not appear to have grown. Provision is made for radiography and

screening and the controls provide for "free" or "automatic" operation. The company also exhibited a four-valve unit of small dimensions designed to load a 6-kW tube to its maximum capacity on all exposures.

Newton & Wright, Ltd., exhibited a new model trolley switch-table (illustrated). This is suitable for operating in connection with any diagnostic equipment and includes a tube selector panel neatly mounted on the centre of the table. By insertion of a two-pin plug, the operator may connect the h.v. unit to any required tube through the medium of a new solenoid-operated, oil-immersed selector switch. In conjunction with the latter, the company also exhibited a new model



[*Elec. Rev. photo*

"Rotalix" tube equipment (Watson & Sons)

h.v. junction box and specimens of earth-shielded h.v. cables and insulators, thus providing for a complete shockproof installation suitable for serving several pieces of examination equipment from one transforming unit.

G.R.S.A., Ltd., showed an improved model twin-valve half-wave h.v. unit in conjunction with a highly developed piece of examination apparatus known as the "Tele-Pantoscope." This unit has a maximum output of 200 mA at 80 kVp, higher voltages being obtainable at lower currents. Suppression of the unwanted half-cycle is effected by means of two valves in series, operating at earth potential in the mid junction of the secondary winding. The valves therefore require small clearances only and are oil immersed in the transformer tank.

This apparatus is now equipped with refinements recently only obtainable in the more expensive high output units. When the controls have been set on the switch-desk, operation of a transfer switch enables all operations to be carried out from the examination apparatus.

The exhibits of A. E. Dean & Co. included a new model control table incorporating a mA selector. This consists of a twelve-way socket panel provided with a single jack. Selected currents can be obtained on different tubes, the tube selection being made by a separate switch. An experimental model synchronous motor-driven timer was also on view, being a further development of the well-known Dean timer. This device is designed to energise a diagnostic unit for short times down to one impulse (½ cycle) and provides adjustment for closing and opening at different points on the voltage curve.

The stabilised diagnostic unit of Schall & Son, Ltd., incorporates arrangements for dispensing with calibration charts. The pre-reading kV meter is provided with an adjustable compensating resistance, the pointer of which moves over a scale calibrated in mA. Setting this against the milliamperage to be used, sets the reading of the kV meter back to the actual peak voltage which will be applied to the tube when the respective current flows. The voltmeter connected across the primary winding of the filament heating transformer is compensated in a similar manner to allow for differences in the filament resistances of different tubes. F. R. Butt also exhibited a single-valve h.p. unit.

Low Power and Miniature Units

The new Siemens "Röntgen camera" (illustrated) shown by the G.R.S.A. evoked much interest. The apparatus was exhibited as a mobile unit suitable for ward work and was stated to have been designed originally for military purposes. The h.v. unit and tube head are completely enclosed in an oval shaped ventilated housing of very small dimensions for the comparatively high output (max. peak voltage 90 kV, output 3 kW). The h.v. transformer and X-ray tube are both oil-immersed in separate tanks which are assembled together in the housing, the whole being mounted and counterbalanced on a vertical column. Screening may be carried on continuously at 250 W up to 90 kVp and operations may be carried out under free or automatic control.

Another interesting exhibit was the military model mobile X-ray plant shown by Cuthbert Andrews. This incorporates the "Rapidex" apparatus mentioned in my last year's review, it being shown on this occasion complete with control box and demountable examination stand. The apparatus is all-metal, the couch top being formed of sheet aluminium held in tension and the assembly would appear to have many applications, especially where fracture work is concerned.

Stanley Cox, Ltd., displayed an improved model universal all-shockproof equipment of the 30/90 type and designed for stationary work. This apparatus has been improved mainly in mechanical detail. The new "Solus" ward unit is provided with an adjustable vertical tube column, operated by a handle on the front of the apparatus.

Most of the exhibitors showed mobile units. The new "Diadex" range of apparatus manufactured by the Westinghouse Co. and exhibited by the Medical Supply Association, is a convertible range designed for meeting the requirements of those wishing to start with a little equipment, with provisions for extending its utility from time to time. The basic unit is a portable outfit consisting of three main parts easily assembled, comprising a combined h.v. transformer and tube unit, control box and stand. The model illustrated incorporates a 60-tap auto-transformer control providing from 30 to 90 kVp, the tube current being 15 mA. When desired, the tube-tank unit may be replaced by a larger type shockproof tube and the assembly utilised in conjunction with a stationary h.v. unit.

New Therapy Apparatus

The principal exhibit on the stand of the Victor X-Ray Corporation was the "Maximar" oil-immersed deep-therapy unit (illustrated). This apparatus has been specially developed to fill a need where finances or available space, or both, are limiting factors. The design follows the principles originally developed by the Victor organisation for diagnostic units, namely the assembly of h.v. transformer, filament heating transformer, and X-ray tube all together in one tank, oil-immersed and hermetically sealed. The overall dimensions of the h.v. unit are only 32 in. by 24 in. by 15 in., mounting being by means of a fork supported by a double-column stand.

[*Elec. Rev. photo*

New trolley switch-table (Newton & Wright)

Manipulation requires very little effort and position or adjustment is automatically maintained. The apparatus is complete with an adjustable treatment couch and it is stated that the complete installation can be installed in a room measuring 10 ft. by 10 ft., in approximately one day, for a total expenditure well under £1,000.

Newton & Wright, Ltd., had on their stand a very neat and compact control unit for operating one or more deep therapy tubes from a single h.v. unit. The control desk is of small dimensions and is suitable for placing upon a table or brackets, being connected to an automatic control panel which may be placed in any convenient position. The unit is designed to operate in conjunction with an oil-immersed tube selector switch and a remote-controlled stepless induction voltage regulator. All operations are electrically interlocked to ensure cor-

rect sequence of operations and illuminated indicators provide a visual diagram of circuit operations. Many other exhibitors showed equipments for superficial and deep therapy.

Examination Apparatus, Tubes and Shields

The motor-driven tilting couch still continues in favour and most exhibitors showed a representative model or alternatively a combination screening stand and couch. The Solus Electrical Company exhibited a combined motor-driven X-ray and examination couch (illustrated). This apparatus is designed primarily for urological work and consists essentially of a strong tubular frame which may be operated by two pairs of synchronised elevating screws which engage the table top mounted thereon. The screws are provided with clutches so that it is possible to move the table vertically or to alter the angle of tilt. Under the bakelite top is a screening box fitted with a lateral window for the observer, the image produced by the screen being observed in a 45 deg. mirror.

Philips Lamps, Ltd., exhibited a new type shockproof shield known as the "V." This is light and the dimensions are small, clearances between the h.v. insert and the earthed metal envelope having been greatly reduced by the introduction of a lining of "Philite" insulation. It embodies forced draught cooling by means of a built-in fan, but can be supplied, if desired, with a special end cap and nozzle for the attachment of a tube carrying air from a remote blower. The shield will accommodate all fixed anode inserts of the "Metalix" range.

The "Rotalix" rotating anode tube was shown in conjunction with a new protective device which renders it impossible to make a radiographic exposure until the anode is revolving at full speed and guards against the stator circuit being left switched on after the exposure has been made. Another interesting development seen on the Philips stand was a 220 kV, 10-mA therapy tube fitted with an automatic lead shutter operated by the Hammer dosimeter together with a visual indicator, for fitting in the operator's cubicle, for recording the filter in operation during a treatment.

A newcomer to the range of available rotating anode tubes is that shown on the stand of the Victor X-ray Corporation. This follows the usual Victor practice of oil immersion but differs from other rotating anode tubes in that it is provided with a double focus. Its maximum rating would appear to be approximately 30 kW at 80 kVp for 1/40 sec. Therapy tubes seem to have reached a high stage of development and recorded lives of 60,000 to 75,000 mA-hours at 200 kV appear to be giving more satisfaction to the users than the manufacturers.

Radiologie, of Berlin, exhibited a range of X-ray tubes and valves for the first time, although the company has been operating for twenty-five years. The "Total-Protecta" type of diagnostic tube is housed in a shield of insulating material surrounded by a close-fitting basket of earthed wirework. Cuthbert Andrews displayed examples of "Protexray" tubes, other exhibitors of tubes being the G.R.S.A. and the Medical Supply Association.

Diathermy and Ultra-violet Light

Hanovia, Ltd., showed a neat and compact mobile light-treatment unit suitable for ward work. This unit incorporated a U-shaped high-pressure electronic discharge tube and was fitted with all necessary accessories for carrying out treatments. The Marconi-Ekco ultra-short-wave portable apparatus is designed for minor electro-surgery and treatments where small currents are required. Two models are available having wavelength ranges of 10 to 13 metres with 100-W output, and 3.5 to 6 metres with 60-W output in the second case.

Other ultra-short-wave units were seen on the stands of the G.R.S.A. and Stanley Cox. The latter firm also exhibited a new model therapeutic table, designed to cover all the requirements of ordinary electrical treatments.

Italian Electrical Activities

Railway electrification and marine propulsion

THE Italian electricity supply industry reports that during 1936 there has been a considerably increased consumption of electricity for power purposes owing to developments in certain industries. The Società Elettrica Basso Milanese states that its increased output has been absorbed by some industrial plants producing war materials and by others which have found it advantageous to replace Diesel power by electricity.

The Società Adriatica di Elettricità, of Venice, and the Società Meridionale di Elettricità, of Naples, have also increased their sales of electricity for power purposes, but this is said to be due to a great extent to progress in the electrification of the Italian State Railways, for which these companies supply energy. The Nove station of the Società Adriatica is connected by means of a 130,000-V line, built by the Italian State Railways Administration, to the Opicina Campagna sub-station on the Trieste-Postumia railway, on which electric traction has just been inaugurated, through the Udine and the Redipuglia sub-stations on the Udine-Trieste railways. From the Udine sub-station there is a double three-phase 60,000-V line, also erected by the Italian State Railways Administration, to supply the Udine-Tarvisio railway, while a similar line has been built for the San Pietro del Carso-Fiume railway.

In the case of the Società Meridionale di Elettricità a 130,000-V line has been built from Ceprano to Naples to supply the Rome-Naples railway, but the largest works are to be done to connect the Sila hydro-electric stations with the Battipaglia-Reggio Calabria railway, on which electric traction is to be inaugurated in April next year. It is claimed that Italy will then have the largest electric railway in Europe—from Bologna to Reggio Calabria, a distance of about 1,200 km.

The decision of the Italian Government that tariffs for the supply of electricity for lighting and household purposes should not be increased in the course of the next two years has not prevented the study of the possibility of a further exploitation of the resources, especially in view of the increased requirements of power for industry and electric traction. In addition, efforts are being made by large supply companies to extend their systems. Negotiations are in progress between the Società Adriatica di Elettricità and the city of Fiume whereby the existing steam station at Fiume will act as a stand-by, while the supply for the town is purchased from the hydro-electric plants of the Società Adriatica. This Venetian concern has, furthermore, secured the control of the power stations in the districts of Padua, Ferrara and Bologna.

The company has again resumed investigations into the possibility of building a reserve steam station near the Arsa coal mines in order to use the pulverised coal which cannot be sold. The Italian Government is encouraging the study of further hydro-electric development in order to meet the demand which will arise from the recent decision to electrify a further 5,000 km. of railways by 1942.

A proposal has been put forward for the building of an underground railway in Rome in connection with the 1941 International Exhibition which is to be held there. Other projects are an underground connection between the Pozzuoli-Naples Monte Santo railway and the Pompeii-Naples Corso Garibaldi railway in order to relieve the congested urban traffic at Naples; the electrification of the Milan-Como, the Milan-Laveno and the Milan-Novara railways operated by the Ferrovie Nord Milano; and the construction of new electric railways from Milan to Biella and also from Bologna to Vignola.

Electric Marine Propulsion

The first Diesel-electric vessel in Italy was the training vessel *Cristoforo Colombo*, delivered in 1927, with a displacement of 4,000 tons. The vessel has two co-axial propellers operated by 900-h.p. d.c. motors running at 120/150 r.p.m. The prime-movers are two 1,250-h.p. Tosi-Diesel engines coupled to Marelli 220-V generators.

The success of the vessel has induced the Italian Government to order a second training ship, the *Amerigo Vespucci*, fitted with Diesel-electric machinery consisting of two 1,250-h.p. Fiat engines coupled to 740-kW Marelli generators and 110-kW auxiliary generators. The propulsion is effected in this case by a single 2,000-h.p. motor.

A project had been worked out by the Cosulich Line to build two 40,000-ton Diesel-electric liners, in co-operation with the Compagnia Generale di Elettricità, but the negotiations failed. However, the Government, in order to encourage the employment of electric propulsion among Italian shipowners, ordered two Diesel-electric-driven ferry-boats, one of 4,000 tons displacement fitted with Fiat engines and Marelli electrical machinery of a total power of 6,000 h.p., and one with B. & W. engines and Italian General Electric machinery of the total power of 4,500 h.p. Further, a Fiat-Marelli Diesel-electric machinery has been fitted on a rock-cutting ship ordered by the Italian Government, and on four tugs built to the order of the Navy.

The colonial sloop *Eritrea* has been equipped with Diesel-electric propelling machinery practically similar to that fitted on board the *Amerigo Vespucci*, though high-speed Fiat Diesel machinery (about 4,000 h.p.) has been employed. It is stated that studies are being carried out with a view to building further auxiliary electrically propelled naval craft, and the conversion of some of the 30,000-ton Italian liners is being considered.

High-voltage Cable Jointing

A highly practical I.E.E. Transmission Section paper

WE should say that the greater value of the paper, "The Jointing and Terminating of High-Voltage Cables," presented by Mr. W. Holttum, B.Eng., to the Transmission Section of the Institution of the Electrical Engineers on Wednesday last lies in its comparative review of jointing practice by illustrative drawings. From the more limited controversial viewpoint the paper appears to be based upon the dictum that "the problem consists in maintaining at the joint the essential characteristics of the cable in the most economical manner possible."

Straight-type mass-impregnated and pre-impregnated paper-insulated and lead-covered cable work is dealt with exclusively, it being held that such work represents the simplest application of the basic principles for all types of cable jointing, including that for oil- and gas-pressure cables. The author asserts that joint construction uniform with that of the cable and at the same time achieving the characteristics of high conductivity, insulation resistance and electric strength is impracticable by reason of the great skill and time involved.

In a section dealing with the actual conductor joint the relative merits of ferrules and copper braid are discussed, while the welding of the conductors as has been practised in Germany is questioned on the score of the cost of the plant. A warning is also given against the temptation to connect the cores colour to colour where this would mean crossing the cores and consequently a fatter and longer sleeve.

Where compound alone is relied on solely for insulation, fluid compound is said to give less certain results owing to minute irregularities of the conducting surfaces combined with voltage surges which may occur on any system. But the author asserts that the strongest known form of joint insulation consists of a solid mass, completely enclosing and in close contact with the conductor, built up of close fibred material in laminations normal to the direction of stress. Insulation applied under jointing, says Mr. Holttum, whether by hand or by machine, is inevitably inferior to the factory-applied insulation of the cable.

From 22 kV upwards the bulk of the insulation required is such that the time involved for insulating by tape wrapping only can be materially reduced by the use of impregnated paper tubes. One-piece tubes are better electrically, but their use on three-core joints requires a longer sleeve to give sufficient length of core during adjustment.

While the testing for moisture content on site of all jointing materials is advocated, we imagine surprise will be expressed in certain quarters because of the author's dislike for basting. This, he says, tends to drain the surface layers on account of the fluidity of the compound at the temperature necessary to make the process useful for drying out. Hence, and also because of the contraction resulting from the high temperature, spaces are likely to result. Moisture from the atmosphere and from the jointer's hands results only in very minute deposit which can be much reduced by taping cold. It is claimed that the cold wrapping of impregnated tape, each roll being lifted from cold compound immediately before use, and cold compound being smeared on each layer, will result in the occlusion of a negligible amount of moisture and a minimum of air.

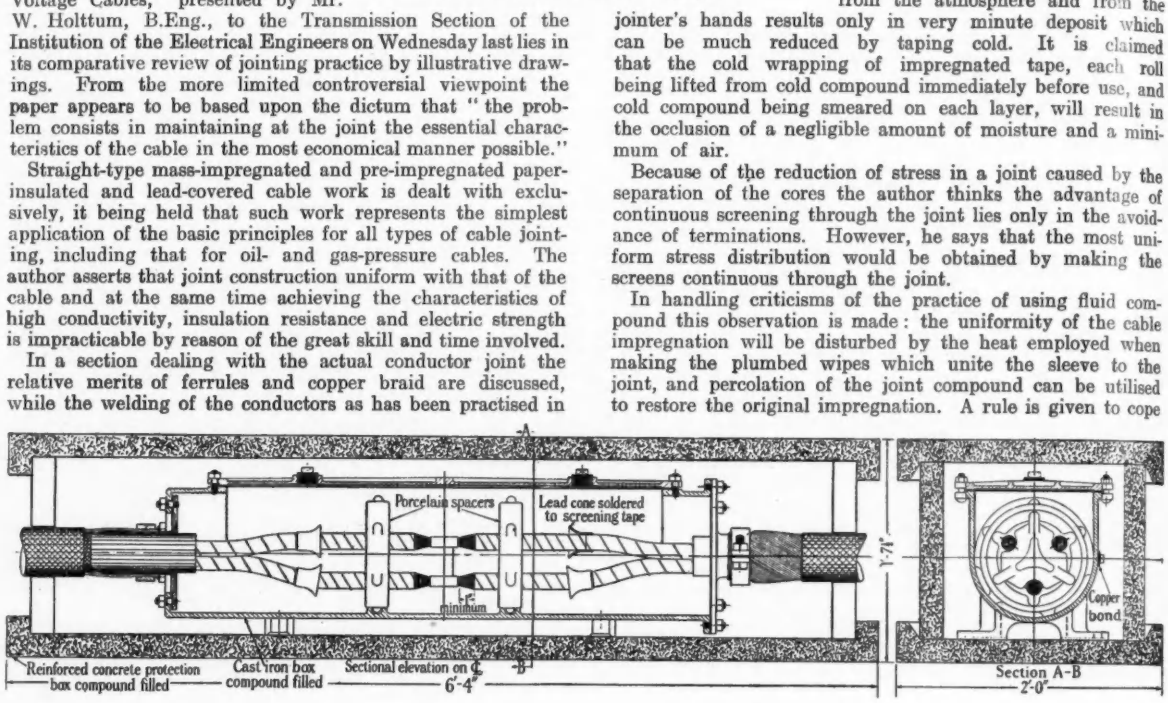
Because of the reduction of stress in a joint caused by the separation of the cores the author thinks the advantage of continuous screening through the joint lies only in the avoidance of terminations. However, he says that the most uniform stress distribution would be obtained by making the screens continuous through the joint.

In handling criticisms of the practice of using fluid compound this observation is made: the uniformity of the cable impregnation will be disturbed by the heat employed when making the plumbed wipes which unite the sleeve to the joint, and percolation of the joint compound can be utilised to restore the original impregnation. A rule is given to cope with the question of migration of compound: make the sleeve of such dimensions that the surplus compound or reservoir capacity is a definite fraction, say 1/60th, of the volume occupied by the paper and compound in the cable length between adjacent joints.

The author gives a list of the advantages of filling a joint with compound instead of relying on solid insulation alone, and he says that a simple way of meeting the requirements of the filling compound is to use compound identical with that in the cable. A new principle in joint filling is cited. Styrene, a special hydro-carbon, is mixed with a common solvent of itself and cable compound. The resulting mixture is said to have great penetrative power which results in welding the applied insulation to the cable insulation. One advantage is the formation of a barrier to the flow of compound, but the author questions whether the cable at the wipe is properly replenished.

In answer to objections to the application of air pressure following the filling of a joint under vacuum it is said that the air cannot gain access to the insulation, the only effect being the saturation with air of the surface layer of compound. There is no evidence that this is harmful, indeed, it may be beneficial by preventing a vacuum in service.

A speculation on future practice suggests the use of some of the recently developed synthetic powders for the primary insulation of joints. In a hot plastic state the material is moulded on to the part of the cable to be insulated.



Normal 33-kV joints. Above: Insulated only by hard-setting compound. Below: With both solid insulation and compound filling

Brick and Pipe Making

Use of the electric drive at an Uxbridge factory

AN excellent idea of the extent to which the modern factory has come to rely upon individual electric drives is obtained at the new flint-lime brick and concrete pipe factory of Hunziker (Great Britain), Ltd., at Cowley, Uxbridge, where approximately a hundred motors totalling 1,350 h.p. have been installed. Apart from considerations of economy and neatness we were particularly impressed during a recent visit by the obvious space saving effected by this system when compared with the old-fashioned group drive with its obstructive and light-obscuring belts and shafting.

The new flint-lime brick and concrete factory of Hunziker (Great Britain), Ltd., at Cowley, Uxbridge

Gravel, the principal raw material used in the factory, is brought from pits nearby to the foot of a conveyor where, after a preliminary screening, it passes up to the head of two Nordberg crushers which are each driven by a 50-h.p. motor. Crushed to a moderate fineness by these, it is then carried up a further conveyor at right angles to the first into silos at the top of the main factory. From here the flint is fed into three ball mills for the final grinding process. To improve the power factor of the load, which is somewhat low owing to the large number of motors installed, the 115-h.p., 720 r.p.m. motor units employed for driving these ball mills are of the auto-synchronous type and they are pipe ventilated.

From the ball mills the flint, now crushed to the required consistency, is taken *via* a conveyor to elevators which raise it to the top floor. Here "jiggers" (shaking conveyors) separate out any material too coarse for recrushing and the remainder is carried to hoppers. Mixing drums underneath receive appropriate quantities of flint and lime (previously prepared in a crusher driven by a 35-h.p. motor) which are steam heated and mixed for forty minutes before being emptied out through the bottom.

The mixture is then carried by an elevator to silos whence it is fed on to a jigger. "Port-holes" in this are opened to admit the mixed material to the presses beneath. These presses, of which there are four, can turn out rather more than one brick a second. The 30-h.p. motors driving them are of particular interest on account of their special characteristics for dealing with heavy fluctuating loads and of their being arranged for reversal so that should the presses jam they can quickly be freed.

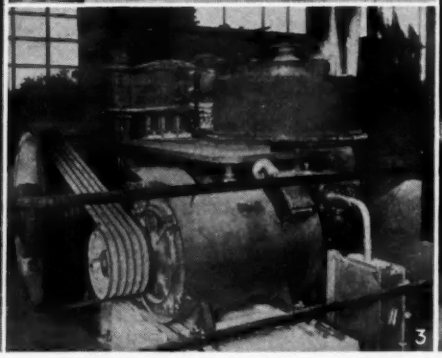
After treatment in the drying ovens the bricks are stacked in the yard outside, ready for use. Apart from its durability and strength (it has withstood pressure tests of 10,870 lb. per sq. in.), an advantage of this type of brick is that it may be obtained in practically any colour desired. When in full operation the factory can turn out 200,000 bricks a day.

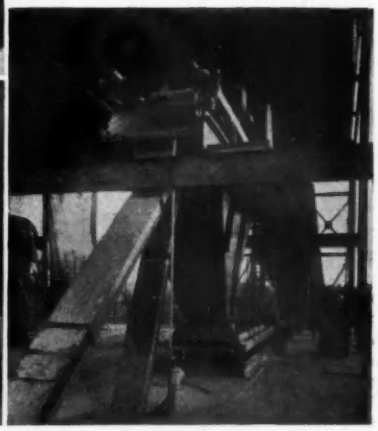
In addition to the manufacture of bricks, the company specialises in centrifugally spun "Superbeton" concrete pipes, for the production of which a separate large section of the factory has been erected. This type of pipe, although new to this country, is already used extensively for main water and sewage services in Switzerland, where it originated. Sizes from 4 to 78 in. in diameter (the latter in 7-ton sections) are being made.

The special methods of construction are of particular interest. After preparation in a "Cumflow" mixer (Lime & Concrete Machinery Co., Ltd.), the concrete is discharged into a "spoon" which feeds it into the mould. It is then spread by means of pneumatic vibrating hammers throughout the length of the mould which is rotated slowly. The speed of the mould is then increased to its maximum, the speed depending upon the size of pipe being made. It is claimed that this speed is greater than that used in any other concrete pipe manufacturing process, and the spinning takes only a few minutes.

To provide the direct current required for operating the variable-speed motors for the moulds, of which there are three, motor-generator sets arranged for Ward-Leonard control (speed variation manually controlled) are provided. The largest is a 100-h.p. machine driving two 35-h.p., 3,000-r.p.m. motors, the remaining two being 50-h.p. models operating two 12½-h.p., 3,000-r.p.m. d.c. motors. To bring the moulds to rest (the largest we saw weighs about 14 tons with the pipe) regenerative braking is employed. Holland-S.L.M. compressors are used to operate the pneumatic hammers in the mould, the compressed air being introduced *via* the head-stock, clamp ring and face plate.

The use of a patented perforated mould lined with filter cloth, combined with the high speed, results in the production of a concrete of remarkable density and strength, while the internal surface, which is never touched either mechanically or by hand during or after manufacture, is perfectly smooth and completely watertight. The concrete is so matured during spinning that the pipe can immediately be stood up and the mould stripped from it.





1. "Emcol" motor driving elevator. 2. Two 115-h.p. auto-synchronous ball mill motors. 3. Brick press. 4. Double-deck screen

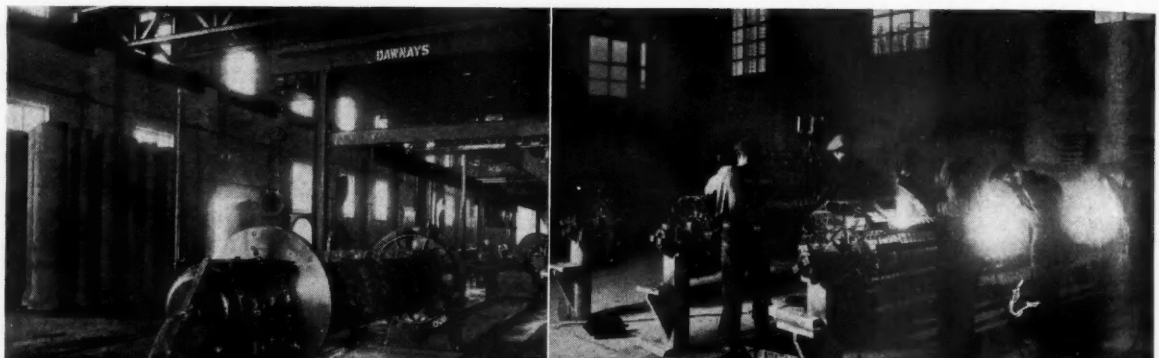
Concrete pressure pipes and pipes for use in ground liable to subsidence require reinforcement and for this reason a section of the factory has been set aside for the production of wire formers. A special 13-h.p. high torque motor drives the coil-winding machine, the circumferential reinforcing rods being wound in helical form and welded to the longitudinal reinforcing bars at every crossing (nearly 2,000 on each former).

Two welding sets (480A and 800A), both with slip-ring motors, are installed on the first floor to supply current for the spot welders, control being effected from switchboards (Standard Switchgear, Ltd.) on the ground floor. These units can be paralleled if desired. For joining together lengths of the former wire there is a small "Microweld" welder (H. A. Schlatter & Co., Ltd.). An 18-h.p. motor drives all the machinery in the repair shop.

For handling the pipes and materials there are seven cranes (from 2 to 10 tons) including four main traversing models running the whole length of the building and three subsidiary units above the spinning machines, &c. These together with a 5-ton traversing crane in the yard were supplied by Herbert Morris, Ltd. In addition there is an 8-ton Stothert & Pitt "Goliath" travelling crane covering the stack yard.

Electricity for the factory is supplied by the Metropolitan Electric Supply Co., Ltd., at 6,600 V from a loop main which is taken to a switchboard (Ferguson, Pailin, Ltd.), comprising a main circuit-breaker and two subsidiary breakers serving two 6,600/415-V transformers (1,250 and 700 kVA). The latter and the l.v. switchgear are by Johnson & Phillips.

With one or two exceptions all the motors, including the Ward-Leonard sets and the main welding units, were supplied by Laurence, Scott & Electromotors, Ltd., and practically all are of the "Emcol" totally enclosed fan-cooled type designed to withstand the extremely difficult conditions. In most cases the motors are fitted with Allen West starters. The electrical contractors were Troughton & Young, Ltd., lighting fittings being supplied by Courtney Russell & Co., Ltd.

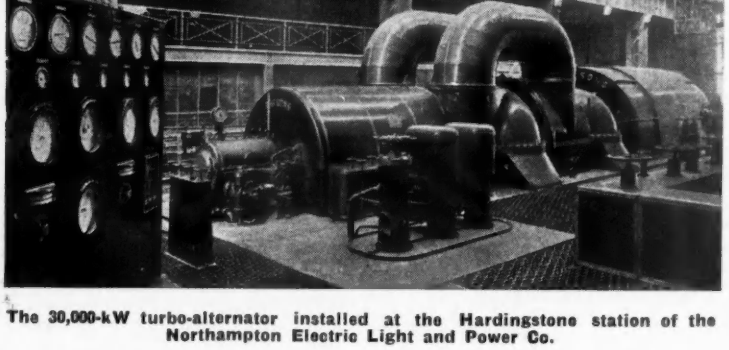


Left: Charging hopper about to enter pipe mould in spinning machine. Right: Welding longitudinal bars to helical outer ring reinforcement for 27-in. pipe

Activities at the Parsons Works

THE success of the system of 33-kV generation originated by C. A. Parsons & Co., Ltd., is demonstrated by the orders received by the Heaton works in 1936. These include three 40,000-kW turbo-alternators for the new Table Bay station, Capetown, and two 30,000-kW for the Mulasore station, Calcutta, which together with the 30,000-kW set put into commission at Northampton recently bring the total kVA of the twenty high-voltage concentric-conductor alternators under construction or in service to 784,000 kVA.

In addition the alternators of the two 50,000-kW sets ordered for Dalmarnock, of the 30,000-kW (single-cylinder 3,000-r.p.m.) set for Hull and of a second 20,000-kW set for East Rand Mines are being wound for 22-kV. Other large machines going through the shops include a third 51,500-kW turbine for Hams Hall, a 30,000-kW, 3,000 r.p.m. tandem turbine with double exhaust and alternator for Norwich, a 24,000-kW single-cylinder, 3,000-r.p.m unit for the Rand, two single-cylinder, 1,500-r.p.m. units for New South Wales and a 20,000-kW set for the Calcutta Electric Supply Corp., Ltd.



The 30,000-kW turbo-alternator installed at the Hardingstone station of the Northampton Electric Light and Power Co.

One of the most technically interesting turbines being built is a 20,000-kW, 3,000-r.p.m. pass-out unit for the Ford Motor Co. of Canada. Initial steam conditions are to be 800 lb. per sq. in. and 800 deg. F., steam being bled for process work at 175 and 7 lb. Imperial Chemical Industries have ordered a second 15,000-kW, 3,000-r.p.m. turbo-alternator to operate at 600 lb. per sq. in. and 800 deg. F. There are also several machines of from 3,750 to 7,500-kW for industrial purposes and for small power stations abroad. Change of frequency on the North-East Coast (40 to 50 cycles) has called for the reconstruction of two 15,000-kW turbo-alternators at Dunston A and one of 25,000 kW at North Tees B to run at 3,000 instead of 2,400 r.p.m.

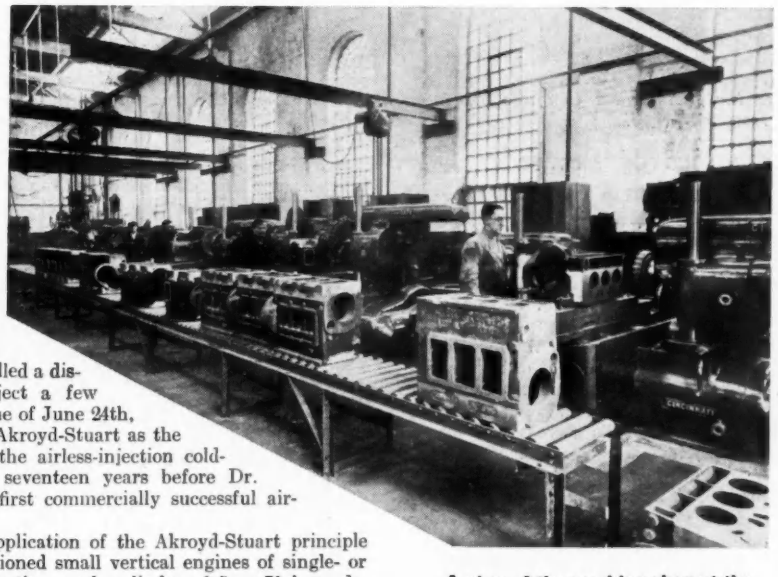
Notable electrical work includes a 25,000-kW synchronous condenser for Mexico, and transformers of 15,000 kVA for Sheffield, of 5,000 kVA (two) for the Northmet Co., and of smaller capacity for China and Johannesburg, all with on-load tap changing equipment. Two transformers giving a total r.m.s. voltage of 500,000 V (700,000 V peak) have also been completed for the company's own high-voltage laboratory. Three reactors for use on 15,000-kVA feeders for the Central Electricity Board and the Newcastle and District Co. have recently been put into service.

The department for the manufacture of silvered-glass reflectors for searchlights is being extended. In addition to its products that are required for naval and military purposes, for aerodrome illumination and for the mercantile marine, there is a growing demand from the film industry for mirrors of from 7 to 25 in. in diameter and from cinema owners for 10 in. ellipsoidal and parabolic reflectors. Important optical work is also being carried out by the subsidiary company, Sir Howard Grubb, Parsons and Co.

The Walker Gate works is employed to capacity mainly in the fabrication of alternator stators, bed plates, condenser shells, transformer tanks and galvanising baths. The foundry has also fulfilled many outside orders including ships' tail-shaft liners.

Small Vertical Oil Engines

DURING a recent demonstration of the new range of heavy-oil engines that has been developed at the Lincoln works of Ruston & Hornsby, Ltd., a protest was entered against the application of the name "Diesel" to compression-ignition engines. The modern solid-injection compression engine, the officials of the company stated, has grown out of the original patents of Herbert Akroyd-Stuart, who first designed the solid-injection oil engine. Engines of this type were being produced at the company's Grantham works some years before Dr. Rudolf Diesel took out his first patent for an oil engine, which, incidentally, was not the one that later proved successful.



A view of the machine shop at the Ruston & Hornsby works, Lincoln

This statement recalled a discussion on the subject a few years ago. In our issue of June 24th, 1932, we referred to Akroyd-Stuart as the inventor in 1890 of the airless-injection cold-starting oil engine, seventeen years before Dr. Diesel produced his first commercially successful air-injection engine.

The most recent application of the Akroyd-Stuart principle is to the before-mentioned small vertical engines of single- or multi-cylinder construction, each cylinder of 5 or 7½ h.p., designed to run on distillate fuels having a specific gravity not exceeding 0.88 and a viscosity not greater than 50 sec. at 100 deg. F. Leading particulars of these engines were given on page 788 of our issue of December 4th.

A tour of the Sheaf Ironwork provides evidence that the tradition of sound workmanship associated with the company is still a first consideration, while methods of manufacture are kept well abreast of the times. Facilities for inspection are provided at every stage of construction, and in a centralised testing department for crankshafts and other machined parts the hardness testing machines are of the same kind of precision standard as the dynamic balancing machines for light and medium weight crankshafts and flywheels.

In No. 2 turnery, where cylinder heads, bearings and liners are dealt with, a notable feature is a battery of heavy combination turret lathes, including, we were told, the largest turret lathe yet built. The small size of the fitting shop compared with the volume of production is a striking tribute to the machine shop work. The erecting shop is divided into six segregated sections corresponding to the various main types of oil engine under construction, the same principle being adopted in the test department.

An apprenticeship training scheme is in operation under which youths serve the first six to nine months of their time in an assorted general department learning the rudiments of their trade. Situated in another part of Lincoln are a foundry, pattern shop, oil-locomotive, pump and petrol-paraffin works and boiler works in which a great variety of special welded and riveted work is under construction.

A New Diesel Engine

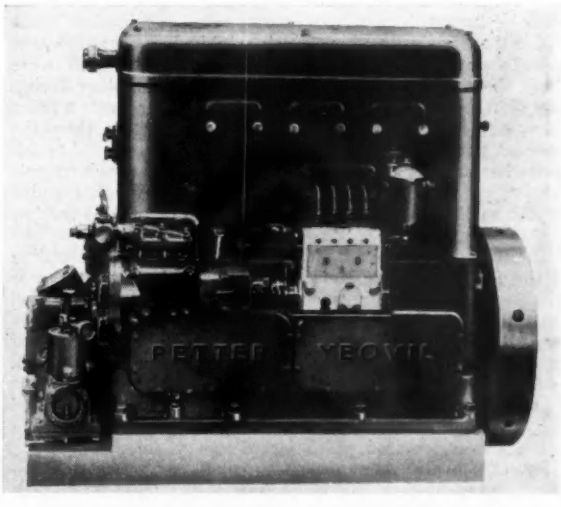
THE "Harmonic Induction" engine which has been introduced to the public by Petters, Ltd., this week is believed to represent the first successful application to the Diesel engine of the principle of pressure waves in the exhaust pipe. The complete expulsion of the products of combustion and the recharging of the cylinders at every cycle is effected under the influence of harmonic waves of pressure. There is no blower, crankcase compression is not employed, nor has the engine the idle strokes of a four-cycle equipment. Because the effective pressure of each consecutive stroke is nearly as great as that of each alternate stroke of a four-cycle engine the new engine has a very low power to weight ratio.

To consider the engine in its simplest form, air inlets are arranged around the cylinder bore at the lower end and the exhaust valve is situated centrally in the cylinder head, so that the air flow is in one direction through the cylinder. When the exhaust valve opens the sudden ejection of the burnt products of combustion from the cylinder sets up a wave motion in the exhaust pipe. This motion is similar to that of the waves produced in an organ pipe, the initial compression wave being formed by the sudden ejection into the exhaust pipe. Immediately following this compression wave there is a vacuum or rarefaction part which completes the wave cycle. This rarefaction is transmitted from the exhaust pipe through the exhaust port into the cylinder, and at exactly the right moment the ports in the cylinder are opened, thus connecting the vacuum in the cylinder to the pressure in the atmosphere, with the result that clean air rushes in from the atmosphere and fills the cylinder completely, so that the cycle of operations in the cylinder may be repeated.

The frequency of the waves in the exhaust pipe is governed by two factors—the length of the pipe and the speed of sound in the medium in the pipe. The latter is fixed by contingencies not under the control of the engine designer, so that it is important that the right length of pipe is used in order that the waves are timed correctly to coincide with the opening of the exhaust valve and air ports.

Each engine is supplied with a definite length of exhaust pipe and a "semi-receiving" chamber into which the "set" pipe terminates. From the receiving chamber the exhaust pipe may be continued to any extent to suit the actual installation, the length of pipe bevond the receiver having no influence on the wave phenomenon. It is possible to connect the exhaust from two cylinders into one pipe as the functions in the pipe take place at an interval of 180 deg. and the motions may be thus arranged to work together.

The exhaust valve is operated from a camshaft geared to the main crankshaft, while solid fuel injection is provided from a pump mounted inside the cylinder housing on the crankshaft. The fuel injection nozzle has a centrally placed single hole of large diameter to minimise carbon choking. As the wave motion only functions at a certain engine speed there is an auxiliary device whereby air is supplied to the engine from the crankcase when starting.



Four-cylinder "Harmonic Induction" engine

We saw three models demonstrated, namely, four-, twin- and single-cylinder units. The four-cylinder equipment is fitted with a small air-compressor and a compressed-air bottle for starting up. The smaller sets will start up by hand from cold.

Meetings and Discussions

Last week the London Technical Group of the E.P.E.A. was addressed by Mr. W. N. C. Clinch upon a subject of first-rate importance—the correct siting of power stations and the best methods of running them. At the I.E.E. on Thursday last week Dr. Dunsheath's paper on his continuous lead extruding machine was discussed; several cable makers and cable "consumers" put forward their experiences and views. Some of the papers read before the Radiological Congress are also reviewed below.

The Economics of Power Generation

MR. W. N. C. CLINCH (chief electrical engineer, Brighton) addressed the London Technical Group of the ELECTRICAL POWER ENGINEERS' ASSOCIATION on the economics of electric power generation on December 1st, at a meeting held in Caxton Hall, Westminster. Mr. W. J. Oswald presided.

In the first place Mr. Clinch set out some of the main considerations in connection with the establishment of a generating station, such as the provision of fuel-handling facilities, adequate condensing water, the cost of land and civil engineering requirements. The following details were given (as a matter of interest, and not as indicating a standard) of the expenditure on a power station of 90,000-kW capacity, and having a site capacity for 350,000 kW:—Land, £8,400; buildings, £174,000; boilers, £354,000; prime movers, £280,000; switchgear, £28,000; ancillary apparatus, £156,000; total, £1,000,400.

Considering basic methods of ascertaining whether or not a power station plant was being operated in the best manner, Mr. Clinch emphasised that, inasmuch as fuel represented perhaps 70 per cent. of the operating costs, the constant preoccupation of the power station engineer must be the attainment of the minimum possible coal consumption for a given output. Valuable as were the innumerable instruments installed in every modern power station to facilitate operation, none of them by itself could do more than provide a check on some particular factor, and it was impossible from their readings alone to determine with any exactness the merits of the performance of the station as a whole during any shift. Discussing means of arriving at a method of control which would show definitely and immediately the efficiency of operation of each shift, and so compare the efficiency of one shift with that of another, Mr. Clinch illustrated the application of the Parsons line, a method introduced by Mr. R. H. Parsons to show the variation of the efficiency of operation with output. When the total weights of coal burned per shift were plotted against the corresponding output in kWh over a period of a fortnight or so, the points so obtained formed a fairly narrow inclined band across the chart, and a straight line could be drawn through them to represent the average about which they would lie. Mr. Clinch exhibited an example chart and showed that if the point for any particular shift were above the line, it followed that the coal consumption during that shift was above the standard. On the other hand, a point below the line represented a performance better than the average. Often at the higher outputs the points tended to fall above the line; a possible explanation was that at such outputs the flue gas temperature tended to rise and the vacuum tended to fall, so that the conditions were not so favourable for low fuel consumption.

The method also lent itself to a much better understanding of the operation of the whole station, for with very little more trouble the station losses could be determined and divided between the boiler plant and the turbine room plant respectively. A second chart could be prepared showing the water evaporated per shift plotted against the corresponding outputs, and a straight line could be drawn through the plotted points as in the first chart. On a further chart Mr. Clinch plotted the consumption of coal and water per shift, and a further equation was provided which served as a useful check.

Mr. Clinch also referred to the paper read in 1933 by Mr. W. F. Burge, before the Institution of Electrical Engineers, on "The Present Practical Limits of Power Station Efficiency," in which it was suggested that one station could readily be compared with another on the basis of efficiency rating.

In opening the discussion, the chairman referred to the tendency to increase steam pressures, and said that a curve which he had seen recently showed that, taking into account capital repayments and the cost of repairs and maintenance, total costs for a given output were decreased with increase of steam pressure up to a certain point, after which the total costs increased with further increase of steam pressure.

Mr. R. A. W. Connor suggested that the Parsons line and Mr. Burge's method fell short of requirements in a two-shift or three-shift station on grid operation, because the station had to carry stand-by plant for the grid, which fact introduced another factor and complicated any method of comparing plant performance. It seemed that some method of correlating average load to steam and coal consumptions must be found.

Mr. Clinch said that the question of steam pressure must depend upon the circumstances applying to any particular station. His station had to operate at two pressures, and that problem was not really so difficult as might be imagined. Turbine size was to some extent a matter of opinion, and he personally considered that a turbine having an output of 30,000 kW, with possibly an arrangement whereby it could generate an output up to 37,500 kW for short periods, afforded flexibility. In an ordinary standard type of power station, where capital cost was an essential feature in the ultimate cost, 650 lb. per sq. in. was about the highest operating pressure that one should use. Although the Parsons line and Mr. Burge's formula did not cover the whole field, once the no-load steam consumption of a turbine and the radiation and other losses of a boiler were ascertained, the plant efficiency could be arrived at.

Mr. J. Price Walters urged that from the economic point of view power stations should be able to utilise efficiently a range of fuels as wide as possible; facilities for blending should be regarded as standard in any coal-handling plant. Mr. W. F. Burge said that the object of his paper was to find a simple and non-scientific method of expressing the efficiency of a station. To state that an efficiency of, say, 23.46 per cent. was attained left one in the dark as to steam conditions, plant item efficiencies and operation factor.

Continuous Cable Sheath Extrusion

OPENING the discussion on December 4th at the INSTITUTION OF ELECTRICAL ENGINEERS on Dr. P. Dunsheath's paper on "The Continuous Extrusion of Lead Cable Sheaths" (reviewed by us last week) Mr. P. V. Hunter described the author's lead press as a first-class development which was urgently needed. It was essentially British since it owed much to the progress that had taken place in this country in recent years in the production of special steels to withstand heavy mechanical stresses at high temperatures. He suggested that as extrusion called for extremely high stresses, the application of the machine should in the first place be restricted to plain lead. A complete understanding of the technique of extrusion was still requisite to avoid the turning out of eccentric tubes.

Mr. F. O. Barralet said that split lead sheaths of British manufacture had been rare, but in German Post Office communication cables no fewer than 176 cases had occurred within nine years; the faults were attributed indiscriminately to the lead and the various lead alloys used. Striking advantages of this continuous extrusion machine were its comparatively small size, close temperature control and the exact thickness of the extruded metal. The avoidance of stop marks was most important in the construction of submarine cables. He himself had considered the possibility of using a sheath thinner than that ordinarily used, merely as a moisture-proof barrier, and covering it with some other protection in order to secure effective resistance to corrosion.

Mr. T. R. Scott suggested that before the replacement of existing machines could be justified the percentage of faults in lead covering due to the method of extrusion should be established. In the United States, where conditions were much more severe than in this country, out of 626 cases examined only sixty-five were directly attributed to the press, and of these twenty-six were not due to the actual extrusion process. The results obtained with the present type of lead press were due to careful attention to technique and the selection of skilled and experienced operators and here the author's machine had economic advantages. Theoretically, continuous extrusion produced perfect sheaths while the hydraulic press could not, but the question really was the probability of either press producing imperfect sheaths. As both types of continuous extrusion machine developed in this country depended on the flow of lead and the control of its temperature, failure of the mechanism or of the operator could result in defects.

Mr. K. Gray spoke, as a lead pipe manufacturer, of the con-

Power station operation
Lead cable sheathing
Radiological papers

siderable metallurgical difficulties involved. He considered that the author's machine took care of the stresses imposed in bending the pipe round the drum as it came from the press in long lengths and also of the difficulties introduced in temperature control when using alloys with different melting points, all of which in other methods made the lead liable to crack in subsequent use.

Mr. H. J. Allcock also referred to the small and diminishing number of lead-sheath failures that were due to the actual process of extrusion. Oxide inclusions could now be prevented when using a hydraulic press, and the difference of 30 per cent. above the lowest temperature shown in the author's graph should be about 10 per cent. Stop marks were not inherently a source of weakness either in the sheath or the dielectric. Tests of bursts under hydraulic pressure invariably showed them to be away from the stop marks and failures at such spots were rare in service. He knew of no case, over a long period of service, in which a fault in the dielectric could definitely be attributed to heating at the stop in the press. Nevertheless if the continuous extrusion machine could be stopped and started without resulting in any change in the structure or thickness of the pipe it was a very important point in its favour.

Mr. W. G. Radley related his experience of the extrusion of some thirty miles of submarine cable when temperature variation at the die at no time exceeded 20 deg. Operating temperatures with the new machine seemed considerably higher than with the old one. Satisfactory results on the old type of press called for considerable attention to the technique of operation, but Dr. Dunsheath's machine removed the pitfalls.

Mr. W. McClelland, speaking from long experience of the use of lead-covered cables on board ship, where they had been subjected to severe vibration, reported that many failures had occurred due to the lead splitting longitudinally; he believed that that was caused by the trapping of oxides along the seam of the cable, and cable manufacturers had agreed that this was so. The continuous extrusion machine had not to be opened up for recharging, and this eliminated the formation of oxide.

Mr. S. R. Siviour referred to failures he had found when taking out cables recently that had been perhaps twenty years in developing. As a user he believed a great advance had been made in the technique of cable sheathing by this machine. Mr. F. W. Purse asked whether equally good, if not better, temperature control could not be obtained with electricity than with gas for heating the lead.

Dr. Dunsheath, in his reply, agreed that lead press operation had been enormously improved during the past ten years but claimed that the samples of extruded lead alloys on exhibition could only have been produced by his machine. He had extruded far more lead containing 2 per cent. of tin than he had extruded pure lead.

Radiological Papers

THE tenth annual congress of the BRITISH INSTITUTE OF RADIOLOGY showed perhaps even more clearly than its predecessors the intimate connection between subjects apparently so remote as electrical engineering, physics and medicine. The measurement of doses of radiation demands the measurement of the extremely small currents, usually of the order of a micro-micro-ampere or less resulting from ionisation in air or other gases. Such measurements formed the subject of a symposium held on December 3rd, at which contributions were made by Dr. D. E. Lea, of the Strangeways Laboratory, Cambridge, Dr. G. W. C. Kaye, Mr. W. E. T. Perry and Mr. D. E. A. Jones, of the National Physical Laboratory, and Mr. T. B. Lane, of Reading University. All these authors described apparatus utilising in various ways the ubiquitous thermionic valve, sometimes in conjunction with hot cathode thyratrons used to operate relays.

The other extreme, from the electrical point of view, was mentioned by Dr. J. D. Cockroft in the course of his Mackenzie Davidson Memorial Lecture on "High Velocity Positive Ions: their application to the transmutation of atomic nuclei and artificial radioactivity." He described in a most interesting manner work carried out, largely at the Cavendish Laboratory, Cambridge, in which atoms were bombarded by positive ions, that is, with the nuclei of helium, hydrogen, and heavy hydrogen, and thereby transmuted into quite different atoms. In general such transmuted atoms are unstable, and immediately break down to give the original atoms, with the emission of radiations. Mentioning that earlier work was carried out with the positive ions (alpha particles) given off by radioactive substances, Dr. Cockroft passed on to later work in which the ions were produced by discharges in gases and accelerated by high electrical potentials. Among the apparatus described was a generator giving a million volts and similar in type to those used in X-ray work. Higher voltages had been reached in America, where Van der Graaf had made an electrostatic machine producing, by friction, up to two million volts. This apparatus is housed in, and fills, a disused airship hangar.

In carrying out work with high-speed ions it is not the exciting voltage which is required, but electronic velocities corresponding to these voltages, so that, for example, if an electron is acted on ten times by, say, 200,000 V, it acquires a velocity as if acted on by two million volts. This is turned to account in an ingenious machine developed by Lawrence and called the "cyclotron." In this apparatus ions are caused to move in a nearly circular path by the action of a magnetic field, and thus describe orbits within two D-shaped hollow boxes placed "back-to-back." A potential difference of 200,000 V is maintained between the members, so that each time the ion passes the gap it is accelerated. In order to ensure that the successive impulses are correctly timed the voltage across the gap is produced by an oscillatory circuit of an appropriate frequency.

By means of this machine ions have been made to travel with velocities corresponding to six million volts. Dr. Cockroft mentioned that most atoms had now been transmuted, and in particular bismuth has been changed into radium E, one of the radioactive materials. By injecting into animals and plant phosphorus made radioactive by artificial means Hevesy has been able to study in detail the movement of the substance in living tissue, and has shown, for example, that some of the phosphorus in the old leaves of plants migrates and is found in new leaves. Electrical means of detection were used, since the amount of radio-phosphorus was far too small to be detected by any known chemical means.

Gauging Cable Sheath Thickness.—In a paper read before the London Students' Section of the INSTITUTION OF ELECTRICAL ENGINEERS on December 7th, Mr. W. E. Laycock described a "Method and Design for Assessing the Thickness of Cable Sheaths during their Extrusion," which depends upon the decrease in the inductance of a coil of wire in the neighbourhood of a non-ferrous conducting body. A means of automatically controlling lead-press heaters by a detector was suggested and a press described. The cause of sheath asymmetry and the defects in present practice in determining uniformity were discussed. Experiments showed the gauge "direct" method to be unsatisfactory because of its susceptibility to temperature changes and a "differential" method was evolved. With this method, the difference of thickness between any two parts of the sheath could be determined, instead of the actual thickness on each side, as in the "direct" method.

This difference of metal thickness is a measure of the circumferential non-uniformity of the sheath, and can be obtained for any position along the cable. The system required a slight modification to the bridge circuit. A heating test which was carried out showed the method to be practically unaffected by temperature changes. The inductance change per mil difference of thickness was approximately 100 times greater than in the previous model, and was sufficient to operate a moving coil microammeter of the rectifier type, requiring a p.d. of 0.66 V for a full-scale deflection of 750 mA.

Although excellent performance was obtained on straight sheaths, some difficulty was experienced when the gauge had to be operated very near to the lead press. Here the sheath formed an arc as the ram ascended during sheathing. By a slight modification of the indicating instrument, sheath irregularities can be automatically controlled during extrusion, and one of many methods was proposed.

The I.E.E. at Nottingham

THE annual dinner of the East Midlands Sub-Centre of the Institution of Electrical Engineers was held at Nottingham on December 4th, Mr. W. F. Furse, chairman, presiding. The toast of "The Institution of Electrical Engineers" was submitted by Dr. H. Schofield, M.B.E., principal of Loughborough College, who suggested that young men were, possibly, too much concerned about professional status and prestige. The chief thing was to obtain from those with greater experience some of the knowledge they alone could disseminate. At Loughborough College there were hundreds of young students to whom the members of the Institution could render invaluable service. As an academician he realised that the final word was with the man of practical knowledge. Response was made by Mr. H. T. Young (Pres. I.E.E.). He said that within a short time the main highways of the country would come under one control, when much could be done, by lighting them electrically from end to end, to protect old people and young people during darkness. Mr. G. F. Dixon, replying to the toast of "The Electrical Industry," proposed by the Lord Mayor of Nottingham, submitted that if developments had not been so rapid in the past in Great Britain as in some countries, progress had certainly been based on safe and sound business principles. In response to the toast of "The Visitors," Mr. S. T. Allen (C.E.B.) said that the country now recognised the grid system as part of the economic structure of the country, and that splendid relationships existed between landowners, manufacturers, contractors and the Central Electricity Board. The East Midlands district had held for some time a very high place in the country for electrical development.

Correspondence

Contributions from readers are welcomed. The writer should give his name and address, not necessarily for publication

Past and Present

I congratulate you on the admirable leading article in your issue of December 4th.

I only wish that some of those who speak so glibly now about "Nationalisation," "Standardisation," and all the other words that end in "ion" could read your leader in order that they might appreciate the incredible difficulties which faced the pioneers of the electrical industry.

London, S.W.1. HERBERT G. WILLIAMS, M.P.
December 7th.

Electrical Aids for the Deaf

All the electrical deaf aids with which I am acquainted suffer from the fundamental defect that for a very low volume of sound, such as a watch ticking at a distance of one foot or the general run of quiet conversation round a small table, the degree of amplification is very small, but for a loud noise like a door slam at close quarters the amplification is painful to anyone not almost stone deaf.

It should surely be within the capabilities of some of your younger readers to produce apparatus which brings low general conversation to the audible level of persons only moderately "hard of hearing," without a painful intensity for large sounds, this requiring apparently a microphone without the low limit of those in common use and an amplifier with an upper limit. A straight valve amplifier with automatic gain control would not do owing to distortion, but if the impulses could be stepped up to high frequency somewhat on the lines of a reversed superhet, it might be that automatic gain control could be applied at that stage, and the impulses then stepped down to audio frequency (this would not do if simply a modulated high frequency).

Another way of tackling the problem is to start with the ultra-sensitive microphone, with a damping system increasing rapidly with amplitude, and a further stage of amplification similarly damped. No doubt there are other ways of obtaining the desired result.

There is a big market awaiting such an apparatus. I am a buyer of at least one at anything up to £100 for my wife's use, and there are thousands of others; the market would expand as the price and size came down. W. E. BURNAND.

Sheffield, *December 1st.*

Contractors and Municipal Tenders

I should like, through the medium of your journal, to draw the attention of electrical contractors to the need, when submitting tenders, for strict compliance with the terms of any advertisement.

The making of standing orders in relation to contracts, by local authorities, became compulsory under section 226 (2) of the Local Government Act, 1933. These standing orders (which were drafted by the Minister of Health) provide that tenders shall be enclosed in plain envelopes, suitably endorsed, and not containing any mark or name indicating the sender. The number of reputable contractors, however, who omit to comply with this condition is astonishing, with the result that tenders are disqualified, in many cases to the disadvantage of the contractor, and to the annoyance of the authority. Again, an advertisement usually gives instructions as to how tenders are to be addressed, but in an unbelievably large number of cases these simple instructions are ignored.

I am writing this because of my personal experience in regard to a recent advertisement in which my Council was interested. Four of the tenders received were wrongly addressed and four contained no endorsement, resulting in their being opened before the proper time and thus automatically disqualified.

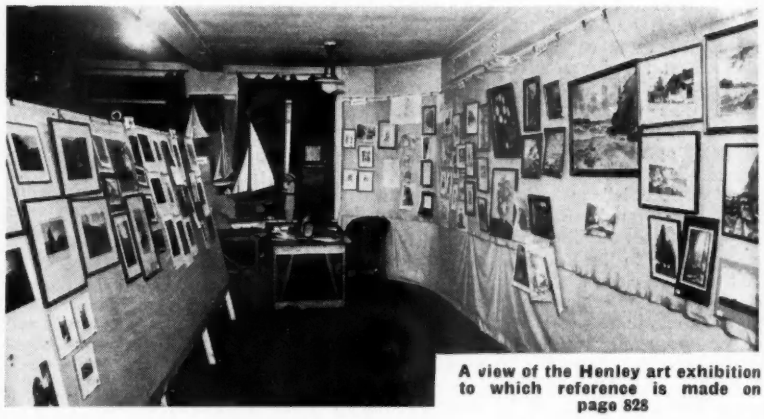
May I ask all electrical contractors carefully to read the simple instructions in regard to tenders contained in any advertisement, and see that they are complied with. It will probably mean more business and will do away with the need, which I can assure you is an unpleasant duty, to disqualify tenders which are in other respects perfectly good and worthy of consideration. ROBERT W. FENTON.

Barnoldswick, *December 2nd.* *Clerk of the Council.*

Industrial Motor Overloads

I read with interest the article by Mr. J. S. Cliff in the ELECTRICAL REVIEW of November 13th, but could not reconcile his statement on B.S.S. overload ratings of motors and the curves showing percentage overload current against safe duration times for overloads. I have not a copy of B.S.S. 168 of 1936 by me when writing this, but I think I am correct in saying that the overload is stated there in percentage torque, which is not necessarily the same as current. In fact, I have been given figures by motor manufacturers ranging from 50 per cent. to 75 per cent. as the relative figures for overload currents to 50 per cent. overload in torque.

Assuming, however, that the overload current is 50 per cent., I note that an open-type motor must be capable of carrying this for fifty seconds, after full temperature rise has been obtained in the machine. Comparing this with the curves, I note that motors of from 1 to 4 h.p. are capable of a 50 per cent. overload for approximately ten minutes and the thermal overload will cut out in approximately eight minutes on this overload, and I am wondering how this wide difference in times comes about. Are the curves taken from cold, while the fifty seconds is after the machine has warmed up?



A view of the Henley art exhibition to which reference is made on page 828

The whole question is of considerable interest to me because I continually find that inspectors of control gear insist on tripping out on 50 per cent. current overload in fifty seconds from warm. On approaching motor manufacturers on this point I am referred back to B.S.S. 168 with which they state the machines comply, and I am unable to get any further. I should welcome comments on the above. At the same time I should like to endorse Mr. Cliff's remarks regarding the desirability of fitting the thermally operated contact in the motor itself. This would not only enable one to use the motor to its full thermal capacity but would provide protection in the windings themselves which appears the logical place for it.

Chester, *December 1st.* P. J. SHIPTON.

A Small Scottish Hydro-electric Plant

In your issue of November 27th (page 740) you published an article on the small hydro-electri cplant at Strathaven. I am particularly interested in this article, having been responsible for the whole scheme. I note in the final paragraph of your article that you state that the new plant was installed by Fraser & Borthwick, Ltd. Actually the complete scheme, including pipe line, surge tank, turbines, power house, &c., was installed by this company.

I consider that this scheme is a particularly good example of the efficient utilisation of water power in its application to a mill, and that there must be many similar situations in which even to-day the old inefficient water wheel is still used.

I note that you consider the most interesting feature of the whole installation is the drive to the old square section vertical shaft which provides the drive to the four pairs of mill stones. I am particularly satisfied with this drive as it necessitated a considerable amount of thought in its design, and so far as could be found on investigation there is not a similar arrangement in any other mill which has been converted.

You state that each machine is served by its own branch from the main pipe-line, with its separate valves just outside the power house. Actually, they are inside.

Glasgow, *December 5th.* A. B. MCNEILAGE.

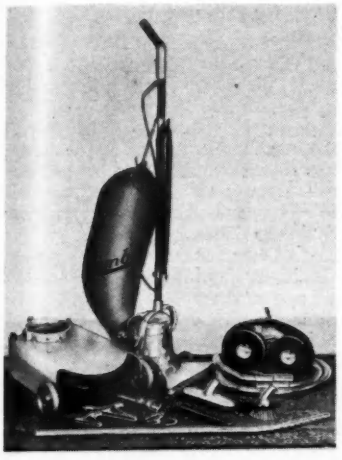
[Will "Corporation Employé" (Manchester) please send his name and full address—not for publication.—EDS.]

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

A Four-in-one Machine

A machine which can be used with equal efficiency as a vacuum cleaner, floor polisher, scrubber and lawn mower has just made its appearance in this country. Strongly constructed of cast aluminium, the "Columbus Model 3," as it is called, weighs 25 lb., and utilises the same 400-W universal motor for all four appliances, it being transferable from one to the other by pressing two levers on either side and lifting it out. The motor has a built-in suction chamber and fan, and incorporates a radio interference suppressor.



The "Columbus Model 3"

The location of the ball-bearing wheels ensures correct alignment of the carpet nozzle, which is screw-adjusted and is provided with air vents for picking up threads, fluff, &c. A full set of cleaning attachments, including a "de-mothing" device, is obtainable.

For polishing, two circular rotating brushes driven at high speed direct from the main spindle of the motor are employed, suction preventing dust rising in the room or being ground into the surface of the floor. The machine is easily transformed into a scrubber by substituting different brushes and closing the suction device.

When used as a lawn mower the machine is fitted with a simple attachment comprising a reducing gear and a circular blade, which rotates horizontally at 600 r.p.m. The whole of the moving mechanism is totally enclosed, and the wheels may be adjusted to raise or lower the position of the blade.

Two other "Columbus" machines, similar in design, are also available, but these are intended solely for use as suction polishers or scrubbers. "Model 1," weighing 45 lb., and fitted with a 500-W motor, is suitable for such places as hospitals, offices, &c., while the small "Model 4," which is only 19 lb. in weight and has a 225-W motor, is particularly suitable for domestic use, a wide range of different finishes being available.

The sole distributors of these machines are ROLLNICK & GORDON, LTD., 80-82, Regent Street, London, W.1, who are also introducing the "Tower" electric floor polish sprayer, applicable for use in hospitals, nursing homes, &c., in conjunction with the "Columbus Model 1" machine. It is 16 in. high, 8 in. in diameter, weighs 11 lb., and incorporates an electric heater for liquefying the polish. A saving of 80 per cent. in material, time and labour is claimed as compared with hand working. The sprayer is fitted with a pressure pump, safety valve, thermometer and manometer gauge. The working pressure is 2½ atmospheres.

Automatic Refrigerator Defrosting

Several "Crosley" refrigerators of A. J. BALCOMBE, LTD., 52/58, Tabernacle Street, London, E.C.2, are fitted with automatic defrosting apparatus controlled by an electric clock. The company is now supplying the "Frostoff" electric defrosting clock separately for use with existing refrigerators. It can be obtained in both the self-starting and hand-started types and is designed for use on a.c. mains. Four models are available, two designed for wall mounting and two to stand on a mantelpiece.

Multi-contact Rotary Switches

Contacts with a diameter of 5 mm. are fitted to the heavy-duty multi-contact rotary switches which have recently been introduced by F. W. LECHNER & CO., LTD., 61, Spencer Street, Clerkenwell, London, E.C.1.

Normally, the switches are supplied without a click action, but they can also be obtained with a stop at alternate contacts, while other variations are ganged units, examples combined with a q.m. and b. switch, and others fitted with resistances for use as precision heavy-duty potentiometers.

The rating is 1,500 V, 6A, and the spindle is insulated.

Automatic Tea-making

Several improvements are incorporated in the new "Teesmade" outfit of TEESMADE, LTD., 82, St. Mary's Road, South Ealing, W.5. As before, the apparatus is intended, at a predetermined time, automatically to boil water in a kettle, infuse tea, switch on a table lamp, and ring an alarm. A specially designed Smith's synchronous self-starting alarm clock is mounted in bakelite, in place of the previous wooden frame and the switches, which are at the back of the clock, can be easily operated.

The "Teesmade" set

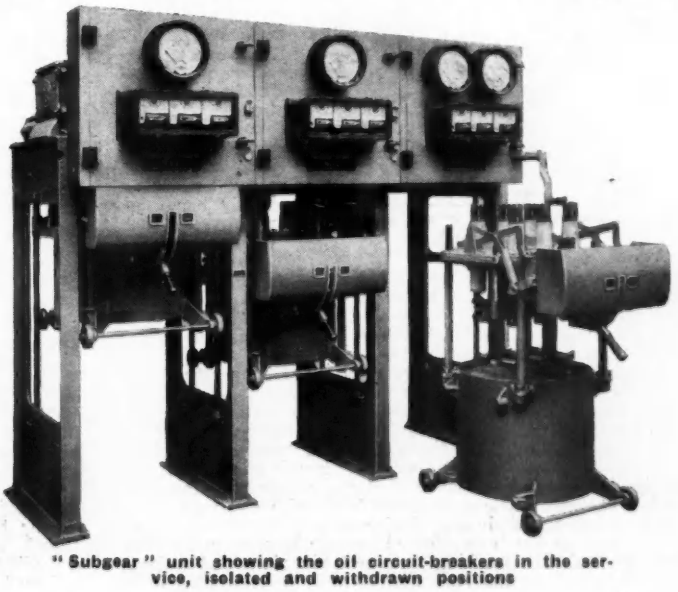
The chromium-plated kettle is fitted with a new pattern screw-on lid which has no breakable moulding attached, but is provided with an anti-splash syphon tube. The element of the kettle can be removed quite simply by unscrewing a small flange nut.

All the metal parts are earthed, and blue, green and ivory finishes are available. The teapot is of chromium-plated aluminium in the café style.

Medium Breaking Capacity Switchgear

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, and Witton Engineering Works, Birmingham, has developed a new range of switchgear of medium breaking capacity under the name of "Subgear." Its features include saving of space, speed of manipulation of the breaker unit for inspection and bus-bar selection, safety to operators, and accessibility.

This gear is available in both single and double bus-bar units, with circuit-breakers having rupturing capacities of from 75,000 kVA to 250,000 kVA, and for high-voltage switching from 3,300 V to 11,000 V. The current capacities range from 300 to 1,200 A. The gear is completely metal-clad and compound and oil-filled. In addition, protection from dust and dirt is given to all live parts and insulation. All operations are fully interlocked to prevent incorrect switching by the operator. In designing the metal-clad unit the vertical isolation principle has been adopted, and it is this feature which is mainly responsible for the saving of space which the installation of this unit offers. With the vertical arrangement of apparatus a unit of minimum width for a given breaking capacity is obtained. Moreover, the unit is arranged so that it can be mounted close against the wall, all cable jointing



"Subgear" unit showing the oil circuit-breakers in the service, isolated and withdrawn positions

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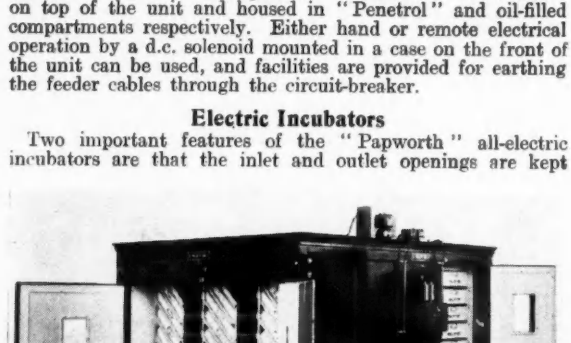
being effected from the front of the unit with the circuit-breaker removed.

Considerable attention has been given to simple operation and maintenance, each unit being equipped with a self-contained, manually operated raising and lowering mechanism. For contact inspection the breaker can be lowered to floor level in about 2¼ min., and afterwards replaced again in service in 3 min. Change-over from one bus-bar to another on double bus units is effected in less than a minute. Off-load or on-load selection of bars can be provided. To facilitate inspection the current and potential transformers are situated on top of the unit and housed in "Penetrol" and oil-filled compartments respectively. Either hand or remote electrical operation by a d.c. solenoid mounted in a case on the front of the unit can be used, and facilities are provided for earthing the feeder cables through the circuit-breaker.

Electric Incubators

Two important features of the "Papworth" all-electric incubators are that the inlet and outlet openings are kept



Model 175 Papworth incubator holding 6,480 eggs

as far apart as possible, the inlet being at floor level and the outlets on the roof, thus averting the danger of recirculating vitiated air, and that humidity, which is so necessary in cabinet incubation, is under full control and can be regulated to within fine limits. Instead of pans a system of automatic vaporising is employed. Humidity can be increased or decreased by regulating the control, the result being registered by the reading of the wet-bulb thermometer which is fitted to the apparatus.

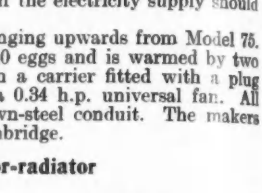
Double thermostatic control is provided. Should the primary, which operates on a variation of ±½ deg. F., fail for any reason, a second safety thermostat operates and rings an alarm bell, which also rings if the electricity supply should fail.

Various sizes are available, ranging upwards from Model 75. This has a total capacity of 1,440 eggs and is warmed by two 500-W strip heaters mounted on a carrier fitted with a plug and flexible steel conduit and a 0.34 h.p. universal fan. All wiring is enclosed in solid drawn-steel conduit. The makers are PAPWORTH INDUSTRIES, Cambridge.

A Convector-radiator

A new type of convector-radiator has been developed by NERSUN, LTD., The Locks, Southwick, Sussex. It is portable and is fitted with two-heat switches. The "Junior" air radiator is suitable for rooms not exceeding 750 cu. ft., and has a loading of 460 W in four separate low-temperature elements. The overall height is 29 in. with an 8-in. by 8-in. cast-iron base and the weight is only 9½lb. The standard model is finished in black and copper, but it can be supplied in six other finishes according to requirements.

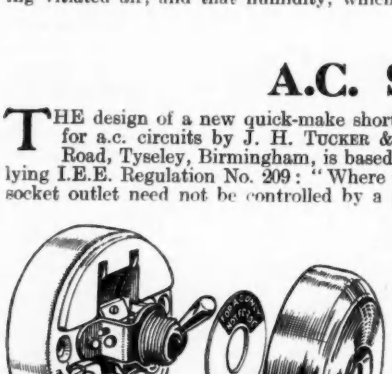
A hot-water radiator is made in two sizes, the larger for rooms not exceeding 1,400 cu. ft. and the smaller for rooms of up to 700 cu. ft., the respective loadings being 250 W and 130 W. The cylindrical boiler contains a small quantity of water, and the only attention required is "topping up" every few months. The time taken to reach full heat is 30 min.



"Nersun" radiator

A.C. Switching Developments

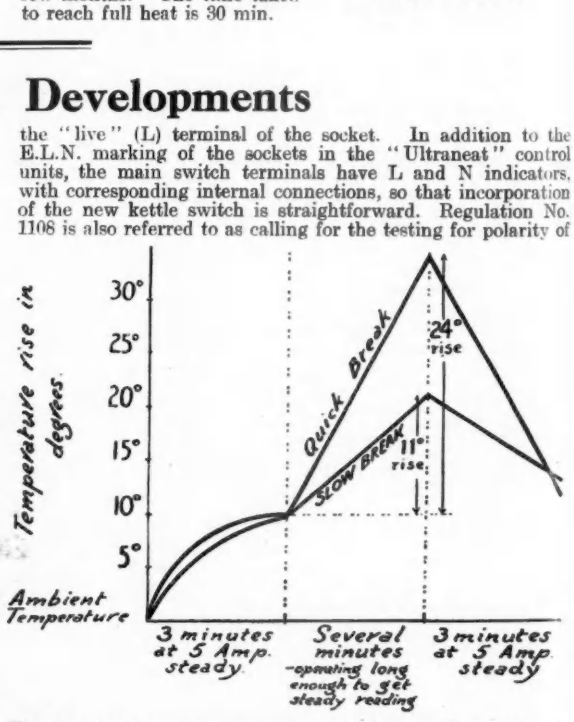
THE design of a new quick-make short slow-break switch for a.c. circuits by J. H. TUCKER & Co., LTD., King's Road, Tyseley, Birmingham, is based on the idea underlying I.E.E. Regulation No. 209: "Where the supply is a.c. a socket outlet need not be controlled by a switch in the final sub-circuit to which it is connected." This idea is said to be the inability to draw out or maintain an arc by ordinary manipulation of a plug and socket where a.c. is concerned. The company claims to have proved conclusively that upon such circuits as those of a.c. kettles a slow-break is highly beneficial when compared with the normal high-speed of a q.b. switch, and photographic reproductions indicate that whereas intensity of an a.c. flash on a s.p. s.b. switch controlling a 1,000-W, 230-V kettle is merely a spark, that of a s.p. q.b. switch is a substantial arc, a severe flash occurring about once in three operations.



A sketch of the "Telac" a.c. slow-break kettle switch

A further series of tests revealed that the temperature rise of the short slow-break switch is less than half that of the quick-break switch when controlling identical circuits. The accompanying graph was plotted from figures obtained from these tests. The company therefore claims that the new switch will eliminate much contact pitting when it is used on a.c. kettle circuits, and the latest Tucker a.c. type "Ultraneat" cooker control units are now available with the new short slow-break a.c. switch for sub-circuit control.

An s.p. type has been adopted because Regulation No. 607 calls for "E.L.N. marking" where 3-pin plugs and sockets are concerned, so that s.p. switches must be connected with the "live" (L) terminal of the socket. In addition to the E.L.N. marking of the sockets in the "Ultraneat" control units, the main switch terminals have L and N indicators, with corresponding internal connections, so that incorporation of the new kettle switch is straightforward. Regulation No. 1108 is also referred to as calling for the testing for polarity of



The comparative temperature rise of slow- and quick-break switches

all s.p. switches before an installation is approved. In that it stipulates that every socket outlet and plug shall conform to the appropriate B.S.S., the company assents that the effect of Regulation No. 1329B is to call for only round-pin plugs and sockets, since there is no B.S.S. for flat pin devices.

A complete range of 5- and 15-A surface, semi-recessed and flush switches is also available for the individual control of a.c. lighting and power loads, as is the 15-A surface type illustrated, and the short slow-break switch movement is also embodied in "Nolok" a.c. type rectangular B.S. gauge switched socket outlets.

The Canadian Electrical Industry

United Kingdom's share of trade increases slightly

THE past year was one of irregular progress in Canada, but at the end of the period a distinct gain in the economic position had been registered. Mr. F. W. Field, C.M.G., H.M. Senior Trade Commissioner in Canada and Newfoundland, in his report to the Department of Overseas Trade on the economic conditions in Canada (Stationery Office, 3s. 6d. net.), states that the old year ended and the new year began with a dominance of factors which should make 1936 generally a much better year than perhaps any of the past six. At the same time, the present position is far less satisfactory than that obtaining before the depression. New mining enterprises have brought about new water-power developments. Based upon output values, three-quarters of Canada's total mineral production of 1933 was produced in Ontario, Quebec and British Columbia, in which provinces mining is carried on almost entirely with hydro-electricity.

The market for small electrical equipment continues to expand. Many Canadian homes install electric refrigerators, ironers, washing machines, curling tongs, vacuum cleaners, toasters, waffle irons, water heaters and other equipment. Canadian manufacturers supply a large part of the market, but imports have their place. In certain instances Canadian makers are engaged in the export trade, the United Kingdom being one of their markets. The Canadian output of electric refrigerators in 1934 was valued at $3½ millions, only five machines being imported from the United Kingdom and 1,755 from the United States. The Dominion is also responsible for the majority of washing machines sold. The United Kingdom, however, has obtained some business in motors for the machines. There is considerable domestic production of vacuum cleaners, but imports account for a larger share than in other lines. Several United Kingdom firms are finding a small market. Of electric ironers the imports are negligible, and these are credited to the United States; Canadian production satisfies practically the whole of the demand. Seventeen factories in Canada manufactured or assembled domestic washing machines during 1935. Imports of washing machines during that year, mainly from the United States, increased to 3,380 units, as compared with 3,014 units in 1934. Canadian manufacturers exported washing machines and parts last year valued at $439,842. The United Kingdom is the most important market and is taking large numbers each year.

The electrical-apparatus industry is one of the strongest and best organised of the country. The sales force is proverbially aggressive, and only close cultivation of the market by United Kingdom firms will secure any business. The production of apparatus in 1934 was $13 millions, and this includes large electrical equipment, batteries, wireless sets, cables and conduits, lighting fittings and miscellaneous equipment. Canada's production in 1934 of motors, generators, transformers and switchgear was valued at approximately $7½ millions, while her imports were valued at less than $2 millions. The imports in 1935 were also valued at less than $2 millions, and in that year a fairly large amount of heavy electrical apparatus was imported. The figures are as shown in the following table:

Canadian imports	From all countries	From U.K.	From U.S.A.
	(Thousands of Dollars)		
Dynamos and generators	248	47	192
Motors	1,100	210	868
Switches, etc.	534	46	484
Transformers	91	25	66

Standardised Dimensions Obstacle

The United Kingdom's share of trade in 1935 was slightly larger than in the previous year, especially in equipment of medium size. The prospects of trade this year were reasonably good and an improvement was anticipated. The market continues to be a difficult one for United Kingdom manufacturers because of the large productive capacity of local concerns, their extensive and influential connections and customers' preference for "Made in Canada" goods. During the past year an additional difficulty in marketing United Kingdom motors has been experienced due to standardisation of dimensions, and there is every indication of this difficulty increasing. The National Electrical Manufacturers' Association of America has standardised dimensions of electric motors up to 50/75 h.p., depending on speed. These standards have been adopted by the majority of companies in the United States and, in turn, by Canadian manufacturers.

Many Canadian purchasers of motors specify N.E.M.A. dimensions, and this automatically rules out United Kingdom motors.

Factory sales of electric storage batteries in 1935 were valued at $3,168,774, and included 553,178 batteries for internal-combustion engines, 14,746 cells for farm lighting, 4,333 cells for railway service, and 3,643 batteries for motor cycle starting. During 1935 the imports of batteries of all kinds, including parts, were valued at $294,467 and exports at $345,517. The United Kingdom contributed $63,605 of the imports.

The quantity of electric lamps made in Canada last year was over 32 millions. More than 23 millions were standard size, all types. The balance were miniature size. The imports comprised 143,786 incandescent carbon-filament lamps and 2,242,934 incandescent metal-filament lamps, the United Kingdom's share of the latter being 32,615. The principal import sources of supply are the United States, Japan, the United Kingdom and Germany, in the order named.

Lamp Manufacture

A company in Ontario has completed an arrangement to manufacture and sell incandescent lamps in Canada in association with one of the largest manufacturers of these lamps in the United Kingdom. The company hoped to place the new product on the market by October.

The available water power in Canada is estimated at 20,347,400 h.p. under conditions of ordinary minimum flow and 33,617,000 h.p. ordinarily available for six months of the year. The total turbine installed capacity is 7,909,115 h.p. Although no new hydraulic construction of any magnitude has been initiated since 1931, additions to existing developments and the development of a number of sites to meet local mining and municipal demand resulted in a net gain in hydraulic installation during 1935 of 362,080 h.p. Approximately 88 per cent., or 6,946,241 h.p., of Canada's total hydro-electric installation is developed in central power stations. Pulp and paper mills have an aggregate installation of 605,346 h.p., or 7.7 per cent. of the total, while the installation for other purposes amounts to 357,528 h.p., or 4.5 per cent. of the total. The low cost of hydro-electricity is indicated by the average revenue per kWh generated. After deducting the revenue received from inter-station sales, the average revenue per kWh received from the actual customers during 1934 was only 0.549 per cent. (about ¼d.) per kWh. The newsprint industry is one of the most important factors in the demand for power. A total of 8,360,422,922 kWh was purchased during 1934—more than 41 per cent. of the total output of hydro-electric stations.

The Canadian Radio Broadcasting Commission established new stations in Quebec City and in Windsor, Ontario, and now has control of full time on seven stations. There are fifty-two broadcasting stations in Canada, which meet all the technical requirements of the Commission. The number of private listeners' receiving sets as at March 31st, 1935, was 812,335, as compared with 598,358 in 1932.

World Exports of Electrical Goods

THE total values, in Reichsmark, of the shipments of electrical machinery and apparatus by all the leading exporting countries during the first halves of 1935 and 1936 are published in *Elektrotechnische Zeitschrift*. The figures for the 1936 period are reproduced below together with notes of increases or decreases compared with the first half of 1935. The half-yearly grand totals for all the countries named were 442,700,000 Rm. in 1936 and 406,800,000 Rm. in 1935, while the grand total for the whole of 1935 was 877,000,000 Rm.

	Jan.–June, 1936. Million Rm.	Inc. or dec. Jan.–June, 1935. Million Rm.
United States	119.1	+ 18.0
Germany	117.1	+ 12.0
United Kingdom	87.0	+ 9.3
Holland	28.8	— 0.7
Japan	17.0	+ 6.0
France	14.3	— 2.3
Switzerland	13.7	+ 0.7
Sweden	12.4	+ 0.4
Belgium	10.8	+ 1.6
Austria	6.6	— 0.1
Canada	6.6	+ 1.3
Hungary	5.6	— 0.2
Czechoslovakia	3.7	— 0.1

In the increase on the preceding half-year of 36,000,000 Rm., or 8.8 per cent., the leading participants were the United States, Germany, Great Britain and Japan, which together increased their shipments by more than 10 per cent. Germany's share rose from 25.9 per cent. to 26.4 per cent., but nevertheless her place as the foremost exporter was ceded to the United States, whose percentage stood at 26.9. The advance (55 per cent.) shown by Japan was striking; it placed her fifth on the list, before France, Sweden and Switzerland.

New Books

Electronics and Electron Tubes. By E. D. McARTHUR. Pp. 173; figs. 89. London: Chapman & Hall, Ltd. Price 12s. 6d.

In the preface to this excellent book the author states that he has tried to describe the fundamental principles which govern the action of all electron tubes. He has succeeded in doing this in a way which will be intelligible not only to the serious student of electronics, but also to the newcomer.

The opening chapter describes in simple language the fundamental concepts of the electron, the atom and the molecule. In the second chapter other fundamental considerations relating to electron devices are described, and the reader cannot fail to be impressed by the clarity of treatment of such subjects as ionisation and excitation, electron emission, photo-emission and space charge. The chapter devoted to two- and three-electrode tubes and the effects produced by introducing into the diode further grids and screens makes excellent reading. Perhaps the most valuable chapters of the book are, however, those devoted to gas- or vapour-filled tubes, as here the author has brought together material, much of which was not accessible except to those possessing the original papers and articles. The characteristics of mercury-vapour rectifiers and the use of the three-electrode vapour tube or thyratron for a variety of purposes take up about one-third of the book.

It is to be regretted that it has not been possible for the author to do more than indicate the nature of certain special types of electron tubes, for example, the cathode-ray oscillograph tube and the high-voltage rectifier. A fuller treatment of these highly important devices, similar to that given in the earlier chapters on triodes and tetrodes, would have enhanced the value of the book. The numerous graphs and diagrams with which the book is illustrated add considerably to the value of the text. A bibliography at the end of each chapter gives references to original papers.

Public Utility Industries. By G. LLOYD WILSON, Ph.D., J. M. HERRING, Ph.D., and R. B. EUTSLER, Ph.D. (412 pp.) London: McGraw-Hill Publishing Co. Price 21s. net.

Recent developments in the political economy of the United States have thrust public service corporations still further into the limelight. For this reason a survey of American public utility operations is of particular value at this time.

The authors of this compendious work, after discussing the general characteristics of public utilities and the principles of rate-making (taking special notice of load and diversity factors), deal with transportation, the supply of electricity, gas and water, and communication services, the last embracing broadcasting.

The section dealing with the electric light and power industry is a well-presented up-to-date picture of the situation in the United States. It recounts the progress made in various directions (including rural electrification); describes the Government's power schemes (Muscle Shoals, the Tennessee Valley Authority, the Rural Electrification Administration, &c.); and mentions the vexed question of holding companies, which is more thoroughly studied in the final chapter.

The authors recognise the evils which may arise from the pyramiding of holding company upon holding company, but suggest that, with suitable safeguards, such combinations can show advantages. They counsel moderation on the part of the three parties concerned—the utility companies themselves, the State and the public.

The Alternating-Current Circuit. By P. KEMP. Pp. 104; figs. 57. London: Sir Isaac Pitman & Sons, Ltd. Price 2s. 6d. net.

This little book has been written for the assistance of elementary students, of limited mathematical attainments, who are taking up the study of a.c. theory. The author's treatment generally follows the conventional lines, in which, after a preliminary explanation of alternating quantities and their representation by vectors, reactance, impedance, a.c. power and the elements of polyphase theory are dealt with. There are two chapters of special interest, one on resonance, in which the author has succeeded in explaining a difficult matter simply and clearly, and the other on mutual inductance, which forms an excellent introduction to transformer theory.

The aim of the author has been, as he states in the preface to his work, to strip the mathematical bogy of its terrors. In this respect he hardly seems to have been consistent. On the one hand, the short trigonometrical proof of the ratio of the virtual to the maximum value of an alternating current is avoided, and the student is expected to take this ratio on trust. On the other hand, the final chapters are made to look more difficult than they need be, by formidable proofs of the three-phase power-factor formula, and of the simple theorem that balanced three-phase currents have no residue.

The indiscriminate use of both circular and degree measure for denoting phase angles in the latter chapters is liable to confuse the student, and the definition of three-phase power factor on page 91 is ambiguous. Apart from such minor criticisms, this book can be recommended as an authoritative, helpful and inexpensive manual.

Principles of Radio Engineering. By R. S. GLASGOW. Pp. 520; figs. 344. London: McGraw-Hill Publishing Co. Price 24s. net.

This book, which should be of real value to students of radio engineering, is based on notes used by the author for a number of years in a course on radio communication at Washington University, where he is Associate Professor of Electrical Engineering. The text assumes a knowledge of the principles of electricity and magnetism, but the first chapter is a summary of the theory of alternating currents as applied to radio circuits. Mathematical solutions are used freely and assume a knowledge of mathematics of the standard expected from a student for an engineering degree.

The fundamental principles of up-to-date radio communication at both the sending and receiving ends are dealt with in a lucid manner. The book adheres to principles and omits information which is only of historical value. Practice is necessarily touched upon, but here again the amount of information given is not allowed to encroach on space which would be better reserved for an explanation of principles; in fact, the whole arrangement of the book fits in admirably with its aim. The book is provided with a good index and contents table. A number of problems are given at the end of chapters, and there is an adequate bibliography of papers in footnotes.

Shorter Notices

"Power Wiring Diagrams." By A. T. Dover. (Third edition.) Pp. 216; figs. 272. Price: 6s. net. "Electric Arc and Oxy-Acetylene Welding," by E. A. Atkins and A. G. Walker. (Third edition.) Pp. 394; figs. 178. Price 8s. 6d. net. London: Sir Isaac Pitman and Sons, Ltd.

"Copper for Bus-Bar Purposes." Pp. 161; figs. 29. London: Copper Development Association.

"The Welding and Cutting Year Book, 1936-37." Edited by C. Helsby, C. W. Hamann and F. J. Samuely. Pp. 244; figs. 143. London: Temsbank Publishing Co. Price 5s.

"The Agricultural Landowner's Handbook on Taxation." By R. Strachan Gardiner. (Fifth edition.) Pp. 251. London: Central Landowners' Association. Price 6s. net.

"Electricity in Therapeutics," by H. H. U. Cross. Pp. 380; illus. 239. London: Crosby Lockwood and Son. Price: 25s. net.

"Recollections and Reflections," by Sir J. J. Thomson. Pp. 451; illus. London: G. Bell and Sons, Ltd. Price: 18s. net.

"Beitrag zur Berechnung van Mastfundamenten." (Third edition.) By H. Fröhlich. (Verlag: Wilhelm Ernst and Sohn, Berlin. RM.5.65.)

In the Courts

Unpaid Insurance Contributions

An order for the payment of fines amounting to £144, with £5 5s. costs, and the payment of arrears of contributions amounting to £200, was made at North London Police Court on December 4th against Maxim Lamps, Ltd., Islington, which was summoned for failing to pay National Health and Unemployment Insurance contributions in respect of employés. There were thirty-six summonses in all.

Mr. Leslie Lee, for the Ministry of Health, said that the company was visited in August last when it was found that the cards and books had not been stamped. The arrears for National Health contributions ran from January this year and for Unemployment Insurance from March last year. The total outstanding arrears amounted to £200. Deductions had been made from wages. The company was before the Court on February 13th last and was then fined £7, with £2 2s. costs, the arrears on that occasion amounting to £24.

Mr. J. Clifford Watts admitted the summonses on behalf of the company, which, he said, had been in existence many years. The employés concerned had not suffered and would not suffer any loss. In two instances where employés wished to leave, their cards and books were stamped up at once. The reason that the company had got into arrears was that it had had an extremely bad time. It hoped shortly after Christmas to be in a position to pay all the arrears.

The Magistrate (Mr. Basil Watson, K.C.), in imposing the penalties mentioned, allowed the company six weeks in which to pay.

Fraudulent Consumption of Electricity

At Leicester on December 2nd Thomas Wright, a local electrical contractor, was summoned for fraudulently consuming electricity from the Corporation mains. A summons against his wife for aiding and abetting him was dismissed.

It was stated in evidence that a shop adjoining the defendant's house was occupied by Mrs. Wright and lighting was supplied by means of wires connected to the defendant's power meter.

Wright, who said that the work had been done by an assistant without his knowledge, was fined £5. After he had paid the fine his solicitor asked for it to be refunded with a view to the consideration of an appeal, but the application was refused by the magistrates.

Business and Industrial Notes

The Week's News. Showrooms and Exhibitions. New Installations. Overseas Trade. Publicity Material. Trade Announcements. Prices of Materials. Liquidations and Bankruptcies.

The Anglo-Argentine Trade Agreement

In the new Anglo-Argentine Trade Agreement there are two sections of special importance to the electrical and allied industries. First, the tariff concessions accorded by Argentina to United Kingdom goods in the Roca agreement of 1933 are maintained during the term of the new pact, namely, until December 31st, 1939. These concessions covered certain special kinds of metal-clad switchgear and of motors or dynamos and the electrical equipment of motor vehicles. With regard to the 10 per cent. surcharge on dutiable goods, it is provided that this may continue for the present, subject to the understanding that it is the intention of the Argentine Government to maintain the surcharge only if financial circumstances necessitate it. In view, therefore, of the steady improvement in financial and economic conditions in the Republic there is hope that the surcharge will be reduced before long and ultimately abolished. The second special point concerns British capitalised concerns in Argentina. The Government at Buenos Aires repeats the 1933 declaration that it is its intention as regards British public utility and other undertakings in Argentina to accord, so far as lies within its constitutional sphere of action, such benevolent treatment as may conduce to the further economic development of the country and to the due and legitimate protection of the interests concerned in their operation. Generally the tenor of the new agreement is to retain the facilities afforded in the Roca pact for the importing of British goods into the Republic.

Local Exhibition

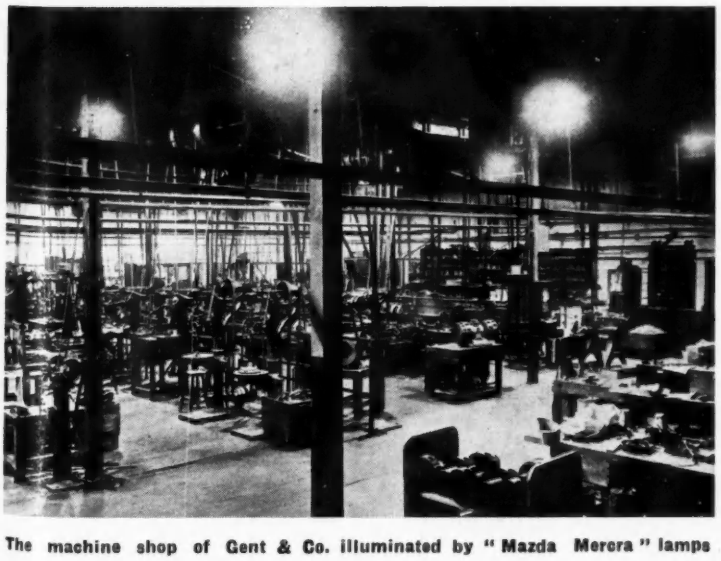
An electrical exhibition arranged by the Mexborough Urban District Council Electricity Department was held at the Empire Ballroom, Mexborough, last week. The exhibition was opened by Mr. T. Williams, M.P. for the Don Valley, and Mr. V. Wragg, chairman of the Mexborough Electricity Committee, presided. They were supported by Messrs. A. N. East of the Electricity Commission, F. Newey, chairman of the Mid-East England area of the I.M.E.A., and Capt. A. W. Brown, of E.D.A. Local dealers supported the exhibition, and there was a comprehensive range of domestic and other appliances, radio sets, &c. A feature was the lay-out of an all-electric bungalow, and interesting items included music, films, and cookery demonstrations.

Works Extensions

Davy Brothers, Ltd., of Sheffield, who have in hand at the present time the completion of an extension to their engineering shops at Darnall, have just decided to make additional extensions by doubling the area of the new shops.

Further Education

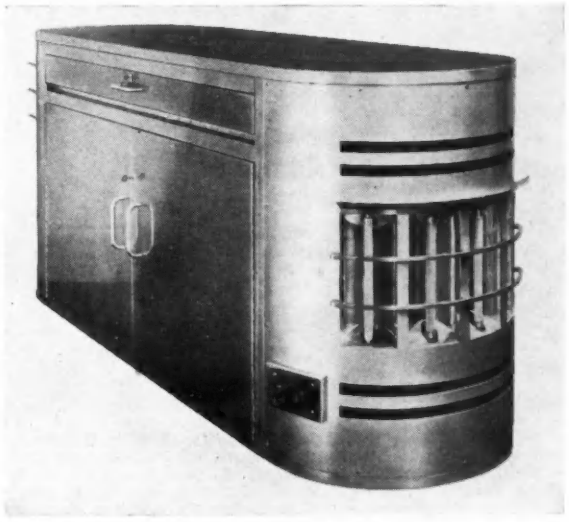
The Board of Education has issued, through the Stationery Office, a new edition of the list (No. 111, price 1s. 5d., post free) of the more important institutions of technical and other forms of further education recognised by it. The list is arranged, under England and Wales separately, in four parts. Part 1 presents a summary of the main provision for further education. It includes all colleges for further education, the principal technical and other evening institutes and technical day classes. Particulars of curricula are given, together with the duration of day courses, the numbers of full-time and part-time students and an indication of the approved schemes for National Diplomas and Certificates in mechanical and electrical engineering, and other subjects.



The machine shop of Gent & Co. illuminated by "Mazda Mercra" lamps

A Hospital Heating Installation

The accompanying illustration shows one of six special central ward electric stoves made by Bratt Colbran, Ltd., to the design of Mr. W. Marchment, and fitted in the new Scarborough Hospital. Each stove is loaded to 8 kW and is 6 ft. long, 2 ft. deep and 3 ft. high, and is in the form of a rectangle with semi-circular ends. The heating elements are situated at each end, and are of the projector type controlled by foot press switches. Cupboard doors in the sides give access to ample storage space, while above the doors a pull out writing bureau is fitted and illuminated from within. The whole stove is made in "Bright Non Rust" metal, which is a pure white-metal alloy taking a brilliant polish. It is emphasised that this metal is not a deposited finish, and is a standard metal used in a number of Bratt Colbran electric radiators of ordinary catalogued types. The top is covered with cork and may be used as a table.



One of the Bratt Colbran electric stoves installed at the new Scarborough Hospital

Machine Shop Lighting

The accompanying illustration shows the machine shop of Gent & Co., Leicester, illuminated by 250-W "Mazda Mercra" lamps in B.T.H. industrial fittings of the dispersive type. The units are mounted at a height of 13 ft., with a 15 ft. spacing. There is a total floor area of 4,830 sq. ft. and the average illumination on the working plane is 12 ft. candles. The installation work was carried out by Gent & Co.'s own electrical staff.

New E.C.A. Members

At a recent meeting of the Council of the Electrical Contractors' Association, a number of applications for membership were considered, and the following contractors were admitted to full membership:—R. J. Griffin (Griffin Bros.), Leighton Buzzard; E. Saunders (E. Saunders (Margate), Ltd., Margate; S. E. R. Beard, Chepstow; D. M. Thomas (Arthur & Thomas), Llanelly; A. Preston, Carmarthen; J. Smith, Swansea; H. Brookes (H. Brookes & Co.), Tunstall; L. S. Dyer, Bingley; G. Clark, Workington, Cumb.; A. Loudon, Manchester; and T. Keen, New Mills. The following contractors were admitted to associate membership:—R. F. Webb, Southampton; B. Davies (Modern Radio), Carmarthen; L. A. Jowett (Trentside Electric), Gainsborough; and A. L. Livesey, Warrington.

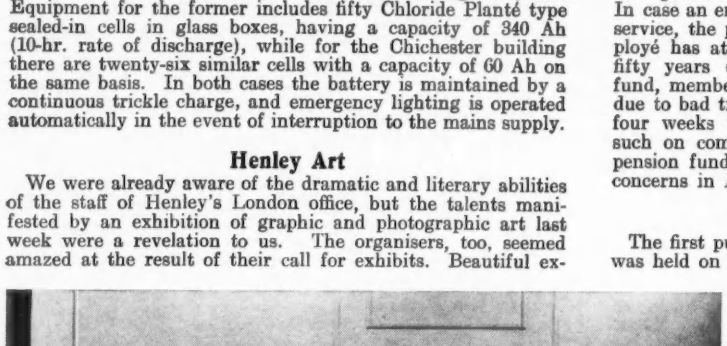
Emergency Lighting Installations

Further information relating to the "Keepalite" emergency lighting installations at the Islington Electricity Department's new showrooms and the West Sussex County Council's new offices at Chichester (ELECTRICAL

REVIEW, November 6th, page 650, and November 20th, page 702) has been sent us by the Chloride Electrical Storage Co., Ltd. Equipment for the former includes fifty Chloride Planté type sealed-in cells in glass boxes, having a capacity of 340 Ah (10-hr. rate of discharge), while for the Chichester building there are twenty-six similar cells with a capacity of 60 Ah on the same basis. In both cases the battery is maintained by a continuous trickle charge, and emergency lighting is operated automatically in the event of interruption to the mains supply.

Henley Art

We were already aware of the dramatic and literary abilities of the staff of Henley's London office, but the talents manifested by an exhibition of graphic and photographic art last week were a revelation to us. The organisers, too, seemed amazed at the result of their call for exhibits. Beautiful examples of oil and water-colour painting, black and white work, etchings and aquatints appeared on the walls, and with them were some remarkable photographs, many displaying an advanced sense of composition. In addition to the pictorial exhibits there were contributions from wood and metal workers, embroiderers and model makers which were very pleasing. It is impossible to mention the names of all whose work was shown, but tribute must be paid to the versatility of Messrs. J. Dunford Smith and A. S. Brewer, whose work appeared in several classes, and reference made to the exhibits of Mr. Kelly in the photographic section.



The E.C.A. Colchester Branch Dinner
Standing (from left to right): Messrs. A. P. Dean, N. V. Everton, Chapman (commercial assistant, Colchester), R. W. Kennedy, L. C. Penwill, H. E. Blackiston, G. P. Dixon, D. H. Butcher, E. H. Skinner, E. Frisby, A. H. Seabrook and B. L. Kay (branch hon. secretary)

Lamp Factory Extensions at Edmonton

Referring to the description of the extensions to the Edmonton factory of Atlas Lamp Works, Ltd., in our last week's issue (page 791), we inadvertently described the apparatus illustrated as a capping machine instead of a sealing machine.

Pension Schemes

A scheme to provide pensions for all permanent employés of the Telegraph Condenser Co. was announced by the chairman and directors of the company at a recent meeting of the employés in the works canteen. It is on a contributory basis, and all employés who remain in the company's service will receive a pension at the age of sixty-five. There are well over 400 initial members. Special consideration has been given to women employés who, if they do not wish to take a "paid up" pension on leaving before pension age, have alternatively a saving scheme combined with free life assurance. Trustees appointed on behalf of the management and employés will administer the scheme and special provisions have been included to enable them to build up a fund to provide against any cases of special hardship in respect of the weekly contributions and so forth. The scheme was inaugurated by Willis, Faber & Dumas, Ltd., insurance brokers, London, who continue in an advisory capacity to the trustees.

On January 1st, 1936, the British Oxygen Co. inaugurated a pension fund scheme for its sales, clerical, and managerial staff. Since then the scheme has been extended to include the company's workpeople, and on December 1st the staff and workpeople of subsidiary companies in this country came within its scope. Of the staff 99.5 per cent. of the men and 85 per cent. of the women have become contributory members of the pension fund and of the workpeople 95 per cent. of the men and 82.5 per cent. of the women employed. While the scheme follows generally the lines of other contributory pension schemes to which the company and the individual employés are contributing, there are several points about this one of special interest. For instance, an allowance, computed at the rate of two-thirds of one year for each year, is made for past service from the age of twenty years and onwards since joining the company's service. In the event of ill-health of incapacitating severity the pension becomes immediately payable provided the invalid has served for ten years or more. In case an employé is retired as redundant after twenty years' service, the pension is payable immediately, provided the employé has attained the age of fifty-five years (for men) and fifty years (for women). In the case of the workpeople's fund, members who are paid off on account of lack of work due to bad trade still remain members for a period of twenty-four weeks without contributory payment and continue as such on coming back to work within that period. Similar pension funds are also being started in the company's allied concerns in Australia, South Africa, and India.

Colchester Contractors' Dinner

The first public dinner of the E.C.A. Colchester Sub-Branch was held on December 1st at the Red Lion Hotel, the chairman of the branch, Mr. D. H. Butcher, presiding. Those present at the dinner included the borough electrical engineer, Mr. G. P. Dixon; the deputy engineer, Mr. E. H. Skinner; and the late borough electrical engineer, Mr. W. Frisby. Mr. H. E. Blackiston, chief electrical engineer at Ipswich, was also present. In proposing the "Colchester Corporation Electricity Department," Mr. L. C. Penwill (Director, E.C.A.) explained that the function was originally intended to provide a semi-private farewell to Mr. Frisby and a cordial welcome to the new engineer, Mr. Dixon. It was felt, however, that all members of the electrical trade in Colchester would desire to take part, and hence the present public occasion was arranged. Marked electrical progress had taken place at Colchester in recent years; this was illustrated by the fact that the Corporation had 7,000 cookers on its mains, a figure that represented something like 25 per cent. of the available households in the area. In his reply, Mr. Dixon expressed good will towards the local contractors. He agreed that the relations between supply authorities and electrical contractors should be as close and mutually supporting as possible. The deputy engineer, Mr. Skinner, also spoke. Mr. Blackiston extended cordial wishes to Mr. W. Frisby for a happy period of retirement. A toast to the E.I.B.A. (for which a collection was made) was proposed by Mr. N. V. Everton (chairman of E.L.M.A.), Mr. A. Hugh Seabrook responding.

The Empire Exhibition, Johannesburg

Moffats, Ltd., have a comprehensive display at the Empire Exhibition, Johannesburg, and our picture shows the extensive layout of the exhibit which covers over 1,200 sq. ft. The turntable, on which a cooker and refrigerator are mounted, is operated by a geared electric drive. Numerous switch-testing and other technical data machines are displayed, and there is a miniature model of a Moffat refrigerator in operation. The cookers and other apparatus are floodlighted from the bottom.

The exhibit of Moffats, Ltd., at the Empire Exhibition, Johannesburg

The Smithfield Show

A possible large market for electric cooking apparatus in the meat trade for the preparation of pies, roast pork and chickens, faggots, sausage rolls, &c., is indicated at the Smithfield Club Cattle Show which is now being held (till this evening) at the Royal Agricultural Hall, Islington. The new "Hotric" electric oven made by H. Webb & Co. (Engineers), Ltd., and shown by G. Rushbrooke (Smithfield), Ltd., is particularly suitable for butchers' use, since it is supplied in compact sectional steel units, which are separately controlled, easily cleaned, require the minimum of attention and retain their heat for a considerable period. Butchers will also be interested in the Hobart Manufacturing Co.'s new "Black Beauty" meat chopper which is of an original "streamline" design utilising

chromium and bakelite (in several attractive colours). All working parts are totally enclosed, and particular attention has been paid to ventilation. It has a ½-h.p. motor. The same company has a meat slicer which will carve 48 lb. of hot sirloin in seven minutes. It can be instantaneously adjusted and is constructed almost entirely of duralumin. Contactor control has been introduced on a number of mincing and sausage machines shown by the Peerless Electrical Manufacturing Co., Ltd., which can now supply its bowl cutter separate from the mixer. To their range of "Lion" equipment Herbert & Sons, Ltd., have added a weighing machine the scale of which is automatically illuminated when goods are placed on the plate.

As might be expected, refrigeration and air-conditioning equipment, display counters, and cold rooms play a big part in the exhibition, apparatus being shown by the Lightfoot Refrigeration Co., Ltd. ("Ellarcold"); J. & E. Hall, Ltd. ("Hallmark"); International Refrigerator Co., Ltd.; Smithfield Refrigerator Co., Ltd.; Ernest West & Beynon, Ltd.; York Shipley, Ltd.; and Frigidaire, Ltd. The last-mentioned company is attracting a large amount of attention with a complete air-conditioned shop.

Electrical equipment for the farmer is concerned largely with milk production and distribution. In addition to milking machines (shown by the Alfa-Laval Co., Ltd.; Gascoigne's (Reading), Ltd.; J. & R. Wallace; and the International Harvester Co. of Great Britain, Ltd.) examples of electric cream separators and shearers are to be seen on the stands of R. A. Lister & Co., Ltd., and the Wolseley Sheep Shearing Co., Ltd. Bottle washers are displayed by A. Grabham & Co., Ltd., and Aveling-Barford, Ltd., the latter company also featuring a 15-kW electrode boiler with a working pressure of 10 lb. per sq. in. Thomas & Son (Worcester), Ltd., and H. J. Godwin, Ltd., both specialise in windmills and electric pumps, and among the oil-engine exhibits we were especially interested in one by R. A. Lister & Co., Ltd., demonstrating the increased life (approximately four times) given to cylinders by the "Listard" process. A hopper-cooled Diesel engine is one of the principal items of Blackstone & Co.'s display, and other makers of oil engines, and electric lighting sets include Bamfords, Ltd.; Petters, Ltd.; Ruston & Hornsby, Ltd.; and Fusion-Moteurs.

Reduced Lamp Prices

The Electric Lamp Manufacturers' Association announces reductions in the prices of the larger standard lamps made by its members. The price of the 150-W clear and pearl types is reduced from 4s. 3d. to 3s. 6d.; the 150-W opal type from 4s. 10d. to 4s.; the 200-W clear type from 7s. 6d. to 6s. 6d.; and the 200-W opal from 8s. 6d. to 7s. 6d. The brands involved are "Ediswan," "Cryselco," "Cossor," "Osram," "Elasta," "Neron," "Siemens," "Philips," "Stella," "Mazda," "Aurora," "Bell" and "Cosmos."

The 1937 E.C.A. Conference

The Council of the Electrical Contractors' Association has accepted the Blackpool Corporation's invitation to hold the 1937 conference in that town.

Social Events

The fourth annual dinner organised by the Sports and Social Club of the Blackburn Corporation electricity undertaking was held on December 4th, at the Northgate Emporium. There were several visitors, including Mr. W. A. Royle, borough electrical engineer of Sunderland and formerly of Blackburn, and Mr. Moffat, of Moffat's, Ltd. Mr. Royle proposed the toast of the Club, and he congratulated the Blackburn undertaking on its continued success. Ald. C. A. Critchley, chairman of the Electricity Committee, in responding, said he was glad that the department continued to make headway. It was certainly in a more prosperous condition than ever before in its history. With the goodwill of all concerned, this progress would go on. Proposing the toast of "The Electricity Committee," Mr. R. H. Harral, engineer and manager, gave figures showing the progress made by the undertaking during the last five years. In 1931 there were 13,000 consumers and the number increased to 26,000 in 1936. The kWh sold totalled 24 millions in 1931 against 40 millions in 1936. The reduction in tariffs at the end of the month would be the sixth in five years, while the total annual refund in tariffs exceeded £60,000. The average cost per kWh sold had been reduced by 25 per cent. and new consumers were being connected at the rate of 100 per week. Councillor E. Porter, vice-chairman of the committee, replied.

On December 3rd the Lewcos Social and Athletic Club (London Electric Wire Co. & Smiths) held its annual dance at the new Leyton Baths Hall, when over 500 people enjoyed a pleasant evening arranged by the dance committee, of which Mr. A. H. Tyndall is secretary. During the interval Mr. E. Leete (managing director of the company) introduced the Mayor and Mayoress of Leyton, Mr. and Mrs. E. J. Thorn. Mr. Thorn, who was on the staff of the company in 1910, wished the club continued success.

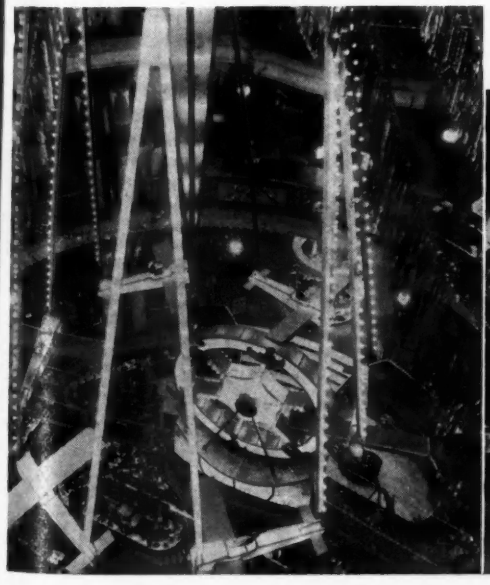
An enjoyable evening was spent by the installation staff of Ericsson Telephones, Ltd., on November 27th when eighty-six sat down to dinner at the Horn Tavern, E.C.4, under the chairmanship of the company's chief installer, Mr. H. Hogarth. Among those present were members of the G.P.O. engineering staff, representatives of Standard Telephones & Cables and members of the Ericsson Co.'s head office staff, the remainder of the gathering being made up from installers, testers and wiremen from various installations now in progress, many travelling from the provinces.

A Display of Light-actuated Apparatus

Rearrangement of the premises of Radiovisor Parent, Ltd., at 28, Little Russell Street, London, W.C.1, has made it possible to provide a representative display of the company's light-actuated apparatus. On entering the showroom visitors can make their presence known by passing their hands through a beam of light and so ringing a bell in the general office. They are also counted by another piece of apparatus, variations of which are available for counting motor vehicles (as in the Mersey Tunnel), articles passing on conveyors, and capsules, &c., for bottling. Equipment for the control of factory and street lighting, traffic islands and guard posts is demonstrated, a scale model showing applications in telephone-kiosk lighting. Examples of smoke indicators, recorders and alarm apparatus are also to be seen, together with an optical pyrometer for the heat treatment of metals and a turbidity indicator for keeping a constant check on the clarity or turbidity of liquids. Other uses of Radiovisor equipment include burglar alarms, door openers, race-timing, hopper control, paper registration, maximum-demand limiter, lift control, garage ramp projectors, oil-flow indicators, flame control, and visibility indicators. For the use of experimenters, schools, &c., the "Raycraft" set is available. An illustration appears on page 832.

Christmas Illuminations

Preparations for the festive season are now well advanced, and our pictures show two examples of illuminations which have been adopted. The illustration on the left was taken at Whiteley's, Knightsbridge, and is a view from above into the "well" of the store. As the picture illustrates, features of the scheme are an illuminated joy wheel and an aero-roundabout. The other illustration shows Paddington (G.W.R.), Station,



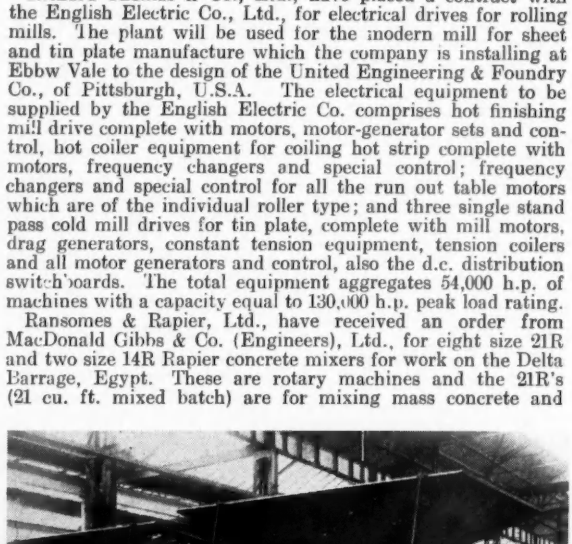
Two examples of Christmas illuminations. Left: Whiteley's Store. Below: Paddington Station [*Elec. Rev. photos.*

which has been gaily decorated. In the circulating area of the station the pillars supporting the roof have become Christmas trees, decorated and illuminated, while Santa Claus with his floodlighted sleigh is in the roof. Garlands are festooned around and across the centre of the area and are entwined with coloured fairy lamps.

Orders Recently Booked

Richard Thomas & Co., Ltd., have placed a contract with the English Electric Co., Ltd., for electrical drives for rolling mills. The plant will be used for the modern mill for sheet and tin plate manufacture which the company is installing at Ebbw Vale to the design of the United Engineering & Foundry Co., of Pittsburgh, U.S.A. The electrical equipment to be supplied by the English Electric Co. comprises hot finishing mill drive complete with motors, motor-generator sets and control, hot coiler equipment for coiling hot strip complete with motors, frequency changers and special control; frequency changers and special control for all the run out table motors which are of the individual roller type; and three single stand pass cold mill drives for tin plate, complete with mill motors, drag generators, constant tension equipment, tension coilers and all motor generators and control, also the d.c. distribution switchboards. The total equipment aggregates 54,000 h.p. of machines with a capacity equal to 130,000 h.p. peak load rating.

Ransomes & Rapier, Ltd., have received an order from MacDonald Gibbs & Co. (Engineers), Ltd., for eight size 21R and two size 14R Rapier concrete mixers for work on the Delta Barrage, Egypt. These are rotary machines and the 21R's (21 cu. ft. mixed batch) are for mixing mass concrete and



Rapier concrete mixers for which Ransomes & Rapier, Ltd., have received an order for the Delta Barrage, Egypt

the 14R's (14 cu. ft. mixed batch) with booms 40 ft. in length and bottom discharge travelling buckets are for work in the block-making yard. All the mixers are electrically driven and mounted on 4 ft. 8½ in. gauge rail wheels. The accompanying illustration shows similar machines for work on one of the Nile Barrages.

An order for ninety-nine Diesel rail-cars has been placed with the English Electric Co., of Preston, by the Buenos Aires Great Southern and the Buenos Aires Western Railways. They will cost approximately £400,000. The placing of this considerable contract will directly and indirectly provide a year's work for 1,600 persons.

Trade Announcements

Harold F. Ward, Ltd., inform us that they purchased the assets as from December 1st of Dagnall (Radio and Electrical), Ltd., in which is incorporated the name of S. Dagnall, Ltd., of 420 and 441, Stratford Road, Sparkhill, Birmingham. Harold F. Ward, Ltd., will continue the business at the same premises as hitherto in conjunction with their present organisation. Both offices, for the purpose of control and organisation, will be conducted from 420, Stratford Road, Sparkhill, Birmingham.

The Normand Electrical Co., Ltd., is moving to new and larger works, and after December 25th its address will be Neco Works, North Street, Clapham Common, S.W.4. It is hoped that the new premises will enable the company to give quicker deliveries and provide an increase in output of about 50 per cent. over the past six months.

As a result of a street-name change which comes into effect shortly the address of the head office of the Dominion Electrical Co. will be 160, New Cavendish Street, London, W.1.

Hellyar & Sons, Ltd., electrical and radio engineers, are opening a branch business at 435, Upper Richmond Road, East Sheen, on December 14th.

Australian Electrical Imports

During the trading year ended June last imports of electrical machinery and appliances into Australia totalled £3,361,800 in value, representing an increase of nearly 40 per cent. over the previous twelve months. The advance was spread throughout all the principal groups. Imports of telegraph and telephone material, at £462,600, more than doubled in value; those of dynamo-electric machines were £516,400, compared with £285,400; cable and wire £903,700 compared with £646,000; while those of lamps (£209,400) and batteries and accumulators (£24,400) were slightly above the level of 1934-35. The value of unspecified electrical material was £1,245,500 as against £1,050,000.

Wandsworth Technical Institute Extension

A large new extension to the Wandsworth Technical Institute was officially opened on Thursday last week by Mr. E. G. Culpin, the vice-chairman of the London County Council, in the absence of the Duke of York. As a result of the additional buildings, the Institute, which is located in the High Street, Wandsworth, S.W., is now one of the largest and most modernly equipped in the Metropolitan area. A feature of its work is the attention which is being devoted to evening classes for the technical education of young men for the National Certificate course in electrical engineering, for the examinations for probationary inspector in the G.P.O. Engineering Department and for the examinations in electrical-installation work of the City and Guilds of London Institute. For the purpose of these classes the Institute now possesses an extremely well-equipped electrical department enabling practical work in all sections of electro-technology to be carried on.

Electrical Accidents in Switzerland

In a recent issue of the Bulletin of the Association Suisse des Electriciens details are given of the report on the electrical accidents which occurred in Switzerland during 1935 at installations under the supervision of the Swiss High-voltage Electrical Installations Inspection Department. From the article it appears that there were eighty-three accidents reported during the twelve months, causing injuries to eighty-four persons, twenty of which proved fatal, these being the lowest figures recorded during the last ten years. In addition, there were eighteen persons injured—of whom three died—in connection with electric traction accidents which come within the purview of a different Government Department.

Prices of Materials

Henry Gardner & Co. report, December 9th: No change in the price of copper bars (best selected), sheet and rod. English pig lead, £25 5s., 10s. inc. Spelter, £16 5s., 8s. 9d. dec. English block tin, £228 10s., £2 dec.

Frederick Smith and Co. report, December 9th: Electrolytic copper bars, £49, 5s. dec. Ditto, ditto, wire rods, £55, 5s. dec. Ditto, ditto, h.c. wire, 8¾d., 1/16d. dec. Silicium bronze wire, 9d., 1/16d. dec.

Edward Till & Co. report, December 9th: No change in the price of India rubber, Para fine.

The Ipswich and District Electrical Association

The second Ball of the Ipswich and District Electrical Association was held on December 4th, at St. Matthew's Hall, Ipswich, about 300 people being present. Amongst them as guests of the Association were Messrs. G. P. Dixon (chief electrical engineer, Colchester), P. E. Rycroft (chief electrical engineer, Yarmouth), G. Broadhurst (chief electrical engineer, Clacton), S. J. Watson and Mr. P. J. Campling (Central Electricity Board), Mr. Reynolds (E.D.A.), and Mr. and Mrs. Messenger (Bungay Corporation). The exterior of the building had been floodlighted by Ipswich Corporation Electricity Department, by the courtesy of the chief electrical engineer, Mr. T. E. Blackiston, who is the first president of the Association. The interior had been specially decorated, and by the skilful adoption of 1,000-W floodlights, (provided by Mr. Bowles, of the East Anglian Electricity Supply Co.), flowers and festoon lighting, beautiful effects were achieved. The work was carried out by the Ipswich Corporation Electricity Department and several Association members. Prizes for lucky tickets, spot prizes, dance competitions, &c., were provided by manufacturer and factor members of the Association.

The Norwegian Electrical Industry

The feeling of greater confidence with regard to the future entertained by Norwegian traders at the end of 1933 has been justified by subsequent events. In his report to the Department of Overseas Trade on the economic and commercial conditions in Norway (Stationery Office, 2s. net), Mr. C. L. Paus, Commercial Secretary H.M. Legation at Oslo, states that the demand for goods has increased steadily, there has been a substantial expansion of turnover and purchasing power, and profits have assumed more reasonable dimensions. Dealing with imports, the value of electrical machinery imported during 1935 was 24,989,100 kr., of which the United Kingdom's share was only 1,436,500 kr., or 5.7 per cent. The increase in the volume of orders reaching the engineering industries, which began to manifest itself towards the end of 1933, continued in 1934, and grew still stronger in 1935. Manufacturers of electrical machinery have, on the whole, been well employed during the last twelve months, but there has been no market for large plant. The manufacture of electric cooking and heating apparatus for household use continues to be an important business. The sections of railway, Kongsberg-Hjuksebo and Notodden-Borgestad, were opened for electric traffic early in the current year. On the section Oslo-Ski partial electrical operation has been commenced. The Storting decided in April last that the western line of the section Ski-Kornsjo should be electrified.

New Catalogues and Lists

G. Green & Co., Ltd., 18, Camden Street, Birmingham.—A leaflet describing the "Rocket" safety kettle.

Higgs Motors, Ltd., Birmingham, 6.—New catalogue sections dealing with a.c. motors, battery charging sets, motor controlling gear, d.c. motors and dynamos, tools, gear units, motor generators, polishing and grinding motors, &c.

General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.—An illustrated booklet entitled "Coal Face Mechanisation."

Hogan & Wardrop, Ltd., 25, Old Street, London, E.C.1.—A leaflet describing "Tireless Tim" vacuum cleaners.

Simplex Electric Co., Ltd., 159, Great Charles Street, Birmingham, 3.—A card illustrating a range of "Creda" electric fires.

Burton, Griffiths & Co., Ltd., Montgomery Street, Sparkbrook, Birmingham, 11.—A pamphlet indicating application of the "Solex" system of gauging.

Siemens & General Electric Railway Signal Co., Ltd., East Lane, Wembley.—Details of the "Autoflex" system of traffic control.

A. Reyrolle & Co., Ltd., Hebburn-on-Tyne.—Pamphlets describing air-break switches, oil-break switches, a short-circuit testing station, sterilising cabinets, a.c. switchboard instruments, and electric arc welding equipment.

Wholesale Fittings Co., Ltd., 23-27, Commercial Street, London, E.1.—A 52-page catalogue of modern lighting fittings.

British Insulated Cables, Ltd., Prescot.—Leaflets showing the variety of equipment available in "Pernax" insulating material.

Falk, Stadelmann & Co., Ltd., 83-93, Farringdon Road, London, E.C.1.—A booklet dealing with illumination equipment for the Coronation.

Flinders (Wholesale), Ltd., 14-20, St. Peter's Street, Ipswich.—A composite leaflet of electrical domestic appliances of various makes for the use of electrical retailers.

Drake & Gorham Wholesale, Ltd., 77, Long Acre, London, W.C.2.—A catalogue of Coronation display material.

Bankruptcy Proceedings

J. W. Froggatt and **G. T. Shackleford,** trading together in co-partnership as "F. & S. Radio," electricians, The Coneries, Loughborough.—At the public examination held in this matter on December 4th at the Castle, Leicester, it was stated that when debtors commenced trading in 1934 they had a capital of only £5. Froggatt said that unemployment in the district has resulted in a decline in their sales. The Official Receiver observed that creditors had been pressing all this year. The joint statement of affairs showed a deficiency of £316. The examination was concluded.

N. H. P. Jones, electrical contractor, 15, North Street, Dowlais, Merthyr Tydfil.—Trustee, Mr. T. C. Cadwgan, Government Buildings, St. Mary's Street, Swansea, Official Receiver, released November 23rd.

J. W. P. Swale, radio and electrical engineer and dealer, 28, Dalton Green Lane, Huddersfield.—First and final dividend of 2s. 2¾d. in the £, payable December 10th at 71, Manningham Lane, Bradford.

Midland Electrical Installations (other than S. Hinchliffe and H. Salmon), 443, Meadow Lane. Nottingham, electrical engineers.—Composition of 5s. in the £, payable December 8th at 22, Regent Street, Park Row, Nottingham.

Midland Electrical Installations (separate estate of J. G. Harrison), 443, Meadow Lane, Nottingham, electrical engineers.—Composition of 5s. in the £, payable December 8th at 22, Regent Street, Park Row, Nottingham.

C. S. Berridge, electrical contractor, 83, St. John's Street, Bridlington.—First and final dividend of 2s. 10d. in the £, payable December 9th at the Official Receiver's Offices, Bank Chambers, Scarborough.

C. H. Large (Torquay and South Devon Electrical Co.), electrician, 1, Old Mill Road, Chelston, Torquay.—Receiving order made November 27th on debtor's own petition.

H. V. Curtis, wireless and electrical engineer, 20, Trent Road, Brixton, S.W.—Trustee, Mr. H. S. Gotelee, 9, Arcade Street, Ipswich, Official Receiver, released November 16th.

S. E. Oliver, electrical and radio engineer, 121, Adnitt Road, Northampton.—Trustee, Mr. T. Bengough, 6, The Parade, Northampton, Official Receiver, released November 23rd.

J. Jones, radio dealer, 8, Northgate Street, Aberystwyth.—First and final dividend of 2s. 3d. in the £, payable at 4, Queen Street, Carmarthen.

A. King, wireless and electrical dealer, 6, Beresford Square, Woolwich, S.E.18.—First meeting December 16th at 29, Russell Square, W.C. Public examination January 26th at the Court House, Greenwich.

J. W. Hackett, radio and electrical engineer, 11, Paxton Terrace, Barrow-in-Furness.—First and final dividend of 2s. 6¾d. in the £, payable December 11th at 16, Cornwallis Street, Barrow-in-Furness.

E. James, wireless engineer, Cusworth Lane, Doncaster.—Public examination December 17th at the County Court Hall, Sheffield.

Company Liquidations

Terry's (Hounslow), Ltd., Hounslow and elsewhere.—The statutory first meetings of creditors and shareholders under the compulsory liquidation of this company were held on December 3rd at the London Bankruptcy Buildings. Mr. J. Barwick Thompson, Official Receiver, reported that the company was promoted in March, 1933, as a private company to carry on business as dealers in cycles, wireless receiving sets, electrical goods, &c. The issued capital was £2,042. The liabilities to unsecured creditors were returned at £2,146, and there was a contingent liability of £150 in respect of promissory notes endorsed by the company in favour of another company which financed a part of this company's hire-purchase business. The likelihood of a dividend being paid to the unsecured creditors was dependent largely upon the possibility of successfully contesting the validity of the debentures and of the recovery from certain directors of the amounts unpaid in respect of their shareholdings. The failure of the company was attributed to the fact that the heavy expenses were disproportionate to the turnover and to lack of working capital. A resolution was passed for Mr. Chas. Latham, Assistant, to act as liquidator.

Bellphonic Radio & Lighting Co., Ltd.—Meetings January 8th at 185-188, High Holborn, W.C., to receive an account of the winding-up by the liquidator, Mr. C. Latham.

Gorst Electrical Co., Ltd.—Particulars of claims by December 16th to the liquidator, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C.

F. E. Doran, Ltd.—Winding up voluntarily. Liquidator, Mr. H. Wingfield, 67, Watling Street, E.C.4.

Dissolution of Partnership

Priory Electric Service, electrical engineers, Ford Street, Coventry.—Messrs. T. E. Morton and W. D. Jones have dissolved partnership. Mr. Morton will attend to all debts except those in connection with the refrigerator department, which will be received and paid by Mr. Jones. The business will be carried on by Mr. Morton.

A Coventry Radio Laboratory

TWO centres of radio investigation are maintained by the General Electric Co., Ltd., one for research proper at Wembley and the other for works development at Coventry. At Wembley ample accommodation is available for covering the whole radio industry—from receiving valves and sets to the large transmitting valves such as are used in broadcasting stations.

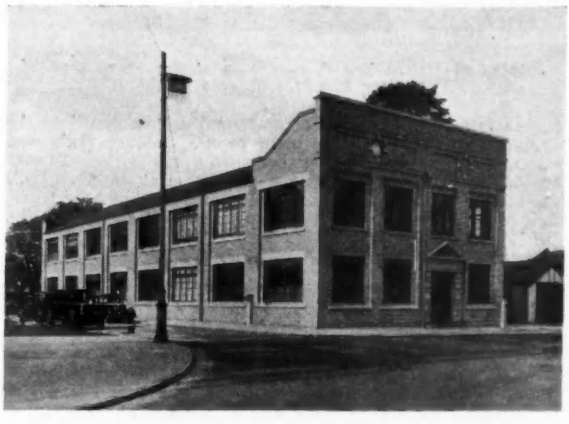
At Coventry, however, owing to the growth of manufacturing activities and the additional room required for the commercial production of television receivers, it was decided early in the year to erect a new building. This is divided into about twenty-four separate offices and laboratories on two floors, the ground floor rooms being soundproof. It comprises four sections for acoustic, electrical, mechanical and circuit development.

For speaker development the actual laboratory work is supplemented by final listening tests on speakers and complete receivers. These tests are carried out in a room in which the constructional details, furniture, walls, hangings and so on are similar to those of a normal domestic living room, with the addition of a bench on which half-a-dozen receivers at a time can be tested and compared, relay devices with remote-control push-button switches being installed for rapidly changing from one receiver to another.

In order that workers may be reasonably free from acoustic and electrical disturbances caused by their fellows a number of small laboratories have been provided on the ground floor, each with signal generators and standard testing equipment, while special equipment (*e.g.*, radio frequency bridges) is installed in two further rooms. Work requiring the total elimination of electrical interference is carried out in a "screened" room.

On the first floor the largest section is devoted to mechanical development. This includes a "life test" where receivers and components are tested under adverse conditions of use, such as high humidities and temperatures. Another section is responsible for the maintenance of the testing apparatus throughout the laboratory and also for the design of apparatus that cannot be purchased; in addition, it acts in an advisory capacity on any new tests which may be called for in the final inspection department.

For the circuit-investigation section four separate rooms are available. Here a wide variety of information received from the Wembley research laboratories, the M.O. valve works, and other sources within or associated with the G.E.C. organisation is sorted out, classified and examined to see how far it is applicable to present or future developments in radio receivers.



The new G.E.C. laboratory building at Coventry

Electricity Supply

Lighting, Domestic, Power

Berkswell (Warwickshire).—ELECTRIC LIGHTING.—The Coventry Corporation is to provide electricity to illuminate the village, two of the principal landowners having agreed for five years to act as guarantors of an annual revenue of 15 per cent. of the capital cost.

Birmingham.—HAMS HALL EXTENSIONS.—The Electricity Committee is to proceed with the following extensions at the Hams Hall power station :—One stoker-fired boiler, steam and feed piping and flue gas ducts (£108,475); one cooling tower, boiler foundations and incidental building works (£56,755); and cabling inside the power station (£2,370).

Blackburn.—CHEAPER ELECTRICITY.—A decision has been made to reduce the "unit" charge under the rateable value tariff from 1d. to ¾d. for the first 250 kWh per quarter.

Bolton.—SUB-STATION.—The Electricity Committee is to erect a sub-station in the School Hill district.

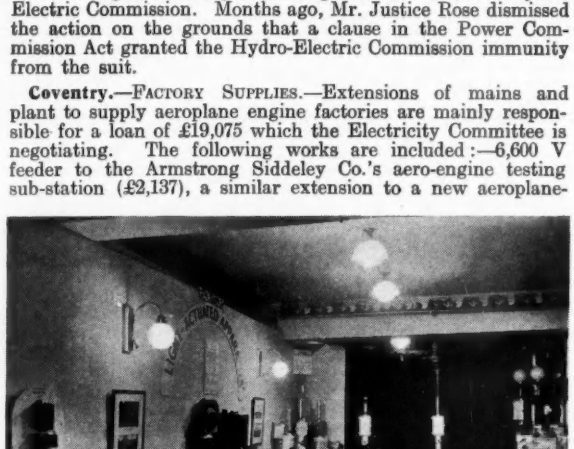
Bradford.—FINANCING EXTENSIONS.—A further £20,000 is required by the Electricity Committee for mains extensions, &c.

SUB-STATION.—At a cost of £3,879 a sub-station is to be provided in Park House Road, Low Moor.

Brighouse.—APPARATUS ON HIRE.—The Corporation has applied for a loan of £4,000 for consumers' apparatus to be let out on hire or hire-purchase.

Canada.—VALIDITY OF ONTARIO POWER ACT.—A *Reuter* message from Toronto states that the validity of certain sections of the Ontario Power Commission Act of 1935 is likely to be finally decided by the Judicial Committee of the Privy Council. The Act, which cancelled power contracts, was last week declared *ultra vires* by a majority of the judges of the Ontario Appeal Court. The Appeal Court decided by three votes to two that the Ottawa Valley Power Company had the right to bring action against the Ontario Hydro-Electric Commission. Months ago, Mr. Justice Rose dismissed the action on the grounds that a clause in the Power Commission Act granted the Hydro-Electric Commission immunity from the suit.

Coventry.—FACTORY SUPPLIES.—Extensions of mains and plant to supply aeroplane engine factories are mainly responsible for a loan of £19,075 which the Electricity Committee is negotiating. The following works are included :—6,600 V feeder to the Armstrong Siddeley Co.'s aero-engine testing sub-station (£2,137), a similar extension to a new aeroplane-



[Elec. Rev. photo

Display of light-actuated apparatus at the showrooms of Radiovisor Parent, Ltd. (see page 829)

engine factory at Aldermoor Lane, and a "tie line" to the Humber works (£3,871), a main to the Daimler Co.'s new aeroplane-engine factory and thence to a sub-station (£4,054), another main to the transformer sub-station at the Alvis Co.'s site at the Baginton Airport (£1,860), and an additional transformer and switchgear at the Abercorn Road sub-station (£7,153).

Dudley.—SUB-STATION.—The S.W. & S. Electric Power Co. is to erect a sub-station near Oakham Road.

Ealing.—ELECTRIC-DISCHARGE LIGHTING.—The Council proposes to install electric-discharge lamps along parts of Western Avenue and Greenford Road.

Eccles.—CHANGE OVER TO ELECTRICITY.—The works of A. Edmeston & Sons, Ltd., at Cawdor Street, Patricroft, are to be converted to electric drive, and a supply is to be given by the Electricity Committee at a cost of £794.

Fareham.—SUPPLY TO MEON.—The Urban District Council has arranged with the Portsmouth Electricity Committee for a supply to be given to Meon, Titchfield, on condition that the revenue equals 15 per cent. of the capital outlay for a period of five years. The extension will cost about £3,600.

Finland.—HYDRO-ELECTRIC SCHEME.—Gradual progress is being made with plans for the hydro-electric development of the extensive rapids on the River Oulu, in Northern Finland. The scheme provides for the erection of six power stations. On the Niskakosi rapids, where there is a fall of 100 ft. over a length of about 4½ miles, there will be three stations, one of 7,500 kW at Kauko, one of 20,000 kW at Jylhämä, and one of 27,000 kW at Nuojua. On the Pyhäkoski rapids (160 ft., 11 miles) there will be a 20,000-kW station at Päli, and one of 66,500 kW at Pyhäkoski. On the one-mile Merikoski reach, where the fall is 20 ft., a 14,000-kW station will be constructed. It is proposed, in case of need, to erect a transmission line between these stations and Southern Finland.

France.—EXPANSION IN PARIS DISTRICT.—Commenting on the annual report of l'Electricité de Paris at a recent meeting of stockholders of the company, the chairman said that they were doing better business than ever before, and that if the economic and financial situation improved they might expect to see an even more rapid rise in consumption. The report showed total sales of 559,490,000 kWh for the year ended June 30th last, an increase of 11,005,579 kWh over the previous year. An encouraging feature of this improvement, he said, was the fact that it was largely due to the growing use of domestic electrical appliances.

HIGH-VOLTAGE TRANSMISSION.—The Midi Railway Co. has recently applied for official approval of a scheme to erect a second 150,000-V transmission line between Lannemezan and Portet, in the Upper Pyrenées department. The Compagnie d'Interconnexion Rhone-Eguzon is also about to erect a 150,000-V line between Jeanne-Rose and Garchizy, Saone-et-Loire, while the Compagnie des Products Chimiques et Electro-metallurgiques is erecting a line to operate at the same voltage between the power station at Bissorte and l'Argentière in the Upper Alps.

Hastings.—SUPPLY EXTENSIONS.—A supply of electricity is to be provided to the Orchard estate at a cost of £110 and to a new housing estate at Rye (£143).

Hebden Bridge.—CHOICE OF LIGHTING.—At the request of the Watch Committee the gas and electricity undertakings each erected a trial installation of street lamps utilising the old tramway poles, and submitted tenders for the supply and maintenance of thirty lamps. The chairman of the Watch Committee, who is also a member of the Gas Board, in moving that the tender of the electrical engineer (Mr. H. H. Sutcliffe) should be accepted, stated that not only was the illumination by the electric lamps much better but it was also much cheaper in cost of maintenance. The electrical scheme was approved. The lamps are 100-W sodium in Wardle "Solux" fittings.

Irish Free State.—RURAL INDUSTRIES.—Addressing a meeting at Galway last week, Mr. T. A. McLaughlin, technical director of the Electricity Supply Board, asserted that rural industries utilising electric motors in small rural factories, or even in the homes of the country folk, could compete successfully with the factory products of the cities and towns, whereas he very much doubted whether, depending solely on manual effort, they could be recreated on an economic basis. He thought this was a question that should be considered by all interested in the prosperity of rural areas. The industries he had particularly in mind were woodworking, dressmaking and tailoring, and toy-making. He also suggested the possibilities of the production of pottery and enamel ornaments with a small electric furnace and jam- and sweet-making with an electric boiler.

Keighley.—ACQUISITION OF HAWORTH UNDERTAKING.—Subject to the approval of the Electricity Commissioners the Keighley Town Council is to take over the Haworth electricity undertaking.

Lerwick.—CHEAPER ELECTRICITY.—Mr. J. Neil, electricity manager, recently reported to the Town Council that the number of kWh sold during the past financial year showed an increase of 40 per cent. over the previous twelve months, while the increase in gross revenue was 16 per cent. In view of these results he recommended a reduction in the lighting flat rate from 7½d. to 7d. per kWh, and in the domestic all-in rate "unit" charge from 1d. to ¾d. After referring to the installation of new plant, the cost of which will be nearly £6,000, he said he was not on this occasion suggesting any alteration in the rates for power, heating and cooking. The Council agreed to the reductions recommended.

London.—CHELSEA.—The L.C.C. is to install electricity at the Chelsea institution at a cost of £1,500.

FULHAM.—The Electricity Committee has obtained permission to borrow £10,000 for the provision of electricity meters, and is seeking sanction to a loan of £103,437 for the further extension of the generating station.

Protective gear for the existing switchgear is to be installed at the Hurlingham and May Street sub-stations, at a cost of £530.

The Electricity Department is to carry out the wiring of the new maternity home, and tenders for fittings and apparatus for lighting heating, power and cooking, radio, call systems, telephones, clocks and emergency lighting are to be obtained in due course. The Department is also to carry out the electrical wiring work in connection with the reconstruction of the baths and washhouses.

It was recently reported to the Electricity and Lighting Committee that vertical cracks had developed in the river wall at Gloucester Wharf, and investigation showed that the foundations were too shallow in relation to the level of the foreshore. The Committee now proposes to accept the tender of Peter Lind & Co., Ltd., for the reconstruction of about 265 ft. of the wall in eighteen weeks at a cost of £13,286. Three lower tenders were received giving a longer time for completion. Lime handling plant is to be erected on a portion of the site, and until the work is completed it is necessary to purchase hydrated lime at a greater cost.

HAMPSTEAD.—Mr. J. Leadbeater, electrical engineer and manager, informs us that the Borough Council has decided to offer domestic consumers an alternative to the present flat rates of 2½d. per kWh for lighting and ½d. per kWh for power. This will be in the form of an all-in tariff with a primary charge based on floor area and a "unit" charge of ½d. both summer and winter, and will come into force following the March quarter meter readings.

Newcastle-under-Lyme.—McGOWAN REPORT.—The Electricity Committee has approved in principle and supports the resolutions passed at the national conference of smaller supply undertakings held in London on October 23rd, and has decided to support the objections of the Association of Municipal Corporations as set out in paragraphs 31, 34, and 35 of their report of October 22nd.

STREET LIGHTING.—The Highways Committee has decided to light the main road from Dimsdale Parade, Wolstanton, to the Bradwell Sanatorium by electricity.

New Zealand.—STATISTICS.—The Public Works Department, operating six hydro-electric stations and distributing power in bulk to various local authorities, sold 713 million kWh in the year ended March 31st last, compared with 656 million kWh in the previous year, an increase of 9 per cent. The North Island system, which was responsible for 564 million kWh of the total sales, produced a net profit of £187,533, against a loss in the previous year of £10,428, this balance being used for the reduction of the accumulated deficiency, which now stands at £339,315. The financial position of the South Island system was affected by the large capital investment in the Waitaki undertaking coming on to the operating account for the first complete year, and there was a net loss of £65,609 against a profit of £16,670.

North Wales.—CRITICISM OF CHARGES.—The Mayor of Flint presided at a meeting held recently in that town and attended by representatives of local authorities in Flintshire and Denbighshire. The object of the meeting was to take steps to secure a reduction in, and uniformity of, electricity charges in North Wales. It was decided to convene another meeting in January to consider the whole question and to draft a protest.

Penistone.—NEW CABLES.—The Rural District Council has given permission for the Yorkshire Electric Power Co. to lay cables to a new housing site at Bull Haw Lane, Silkstone.

Plymouth.—MAINS EXTENSIONS.—The Electricity Committee is to extend mains to housing estates at a cost of £3,100, and elsewhere at a cost of £2,000.

Reading.—STREET-LIGHTING SCHEME.—At a recent meeting of the Town Council it was announced that the Ministry of Health had approved the borrowing of money for Reading's £36,000 street-lighting scheme, into which a public inquiry was held in October. Ald. Venner stated that the plans the Highways Committee had under consideration would be put in hand as soon as possible.

Russia.—WATER SHORTAGE DIFFICULTIES.—According to reports received in Berlin, lack of rain has resulted in the number of turbines running in the Dnieper power station at Saporoshje being reduced to two out of the nine available. Ship traffic on the river is said to have stopped and the sluices to have been closed, and as the river has risen only about 1½ ft. during the autumn there seems little prospect of any early improvement. The iron and steel works and other factories in the Saporoshje valley, which were built in order to provide a load for the power plant, have been greatly hampered and some departments of the steel works have been forced to close down. Another result of the shortage of power is that the electrified Saporoshje-Debalzewo railway has reverted to steam drive. In Dnieprovsk street lighting has been reduced by one half, and the inhabitants have been ordered to use no more than one 25 W lamp in each room. Interruptions in supply have caused inconvenience also in Stalino and the Donetz coalfields, which were hoping to draw electricity from the Dnieper central supply. Although there has been no delay in the erection of the 25,000 kW set at Kirov, in Makejevka, and of the 24,000 kW set at Voroschilow, it has not been possible to utilise them to their full capacity. Troubles of another kind seem to have occurred in connection with the 50,000-kW turbo-generator at Sujevka, and it is reported that this will have to be closed down for overhaul and repairs. It has been decided to hasten the construction of the new 200,000-kW station at Kurachovo, in the Donetz basin, but this is not likely to be ready before 1938.

Seaton Valley (Northumberland).—ELECTRICITY FOR COUNCIL HOUSES.—The Council has agreed to install electricity in houses being erected on the Grange housing estate, and tenders are invited for carrying out the work in ninety-eight dwellings.

Scotland.—SCHEMES IN THE HIGHLANDS.—In the House of Commons on Tuesday the Minister of Transport was asked whether he could state the surplus electrical power at the existing water-power schemes in the Highlands, and whether he would arrange for such power being made available to those desiring to set up industries in those districts. Captain Hudson, replying for the Minister, said that the total plant installed in statutory hydro-electric stations in the Highlands was approximately 117,000 kW and the maximum demand in 1935 was about 86,000 kW, the overall load factor being a little over 47 per cent. He did not doubt that the supply authorities would be glad to enter into negotiations for the use of any available surplus electrical energy.

South Shields.—LOAN.—The Electricity Committee has obtained sanction to borrow £10,000 for services.

CHANGE-OVER DEFERRED.—Following a meeting between representatives of the Central Electricity Board and the Town Council, the latter body has decided to defer for a year its scheme for changing over the electricity supply from 2,000 V to 11,000 V. This decision, however, will not interfere with the Council's scheme for reorganising the electricity undertaking estimated by the electrical engineer (Mr. N. T. Smith) to cost about £200,000. At the meeting between the Board and the Town Council it was stated that the Board would be prepared to change the voltage if the Council would bear the cost estimated at £7,000. If the Council, however, waited another year it would make the change-over for £6,000. The Council has agreed to the latter proposal.

Spalding.—OVERHEAD EXTENSIONS.—Sanction has been obtained to an extension of the overhead line at Fengate, Moulton Chapel, and the Urban District Council has applied for a loan for extensions of the low-voltage distribution supply at Bertie Fen, Pinchbeck.

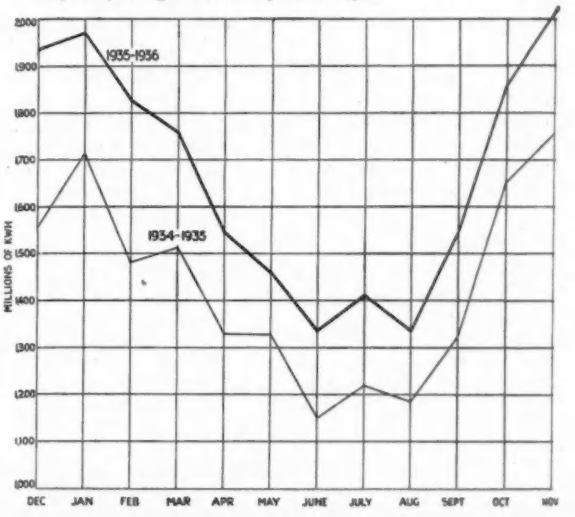
Stroud.—LOWER CHARGES.—The Stroud Electric Supply Co., Ltd., has reduced the fixed charge for each 1,000 W of lamps connected in business premises from £15 to £12 per annum, and the "unit" charge from 1½d. to 1d. For domestic premises the "unit" charge in excess of the allowance made under the annual fixed charge has been reduced from 1½d. to 1d., and the flat rate for heating to 2d. per kWh.

Tintern.—PROPOSED NEW SUPPLY COMPANY.—An old turbine formerly used in connection with the wood-turning industry in the village is to be used by a private company, in process of formation, to generate and distribute electricity. The scheme has been evolved by residents who in the past have taken a leading part in trying to persuade the West Gloucestershire Power Co. to extend its mains to the Wye Valley.

Tunbridge Wells.—ELECTRIC LIGHTING.—The Town Council has decided to have electricity installed in 162 houses on the

Generation of Electricity in November

THE official returns rendered to the Electricity Commissioners show that 2,010 million kWh of electricity was generated by authorised undertakings in Great Britain during November, as compared with the revised figure of 1,758 million kWh in the corresponding month of 1935, representing an increase of 252 million kWh, or 14.3 per cent. The number of working days in the month (*i.e.*, excluding Sundays) was twenty-five, as against twenty-six last year.



The output of authorised undertakings in the twelve months to the end of November, with comparative curve for 1934-35

During the first eleven months of 1936 up to the end of November the total quantity of electricity generated by authorised undertakings was 18,040 million kWh, as compared with the revised figure of 15,638 million kWh for the corresponding period of 1935, representing an increase of 2,402 million kWh, or 15.4 per cent.

Oak Road estate. In 100 of the houses the facilities will include electric cooking and water heating.

Turkey.—SUPPLY PROGRESS.—According to the recently issued report of the Société Turque d'Electricité, of Istanbul, the output of electricity last year was 102,878,463 kWh as compared with 98,799,640 kWh in 1934. The number of consumers increased during the twelve months from 92,455 to 97,542. Due to the larger quantities taken for traction purposes, the present year has seen a further increase in the output, and during the nine months ended with September last this amounted to 79,827,042 kWh as against 74,365,466 kWh in the similar period of last year.

Warrington.—OBJECTION WITHDRAWN.—The Lymm Urban District Council has now withdrawn its objection to proposed overhead lines in its district, and the Corporation is to proceed with its electrification scheme.

MAINS AND SERVICES.—Sanction to a loan of £20,000 for mains and services has been obtained.

West Bromwich.—NEW TWO-PART TARIFF.—A new scale of electricity charges introducing a two-part in place of the three-part tariff has been approved. The concessions will cost over £5,000, of which £2,000 will go to shopkeepers, £2,000 to domestic consumers, and £1,000 to power consumers.

Worthing.—EXTENSIONS.—The Electricity Committee has obtained sanction to borrow £41,140 for extensions, and the supply is to be improved in the central shopping area at a cost of £564.

York.—LOANS.—Sanction to loans of £7,000 for sub-stations, £1,000 for meters, and £12,000 for electrical apparatus has been obtained by the Electricity Committee.

Traction

Australia.—PROFIT FROM MELBOURNE TRAMS.—It is reported in the *Electrical Engineer and Merchandiser* that in 1935-36, for the first time since 1927, the Melbourne and Metropolitan Tramways Board was able to meet all its obligations, including the payment of £111,658 into State consolidated revenue, and to record a small net surplus. The total revenue for the year ended June 30th last amounted to £2,090,755, and working expenses totalled £1,256,457. The net surplus was £1,410. In the previous year the revenue was £2,031,656 and there was a deficiency of £29,438 after paying £113,724 to the State. Although the revenue is increasing, it is still nearly £400,000 less than that of the peak year 1927.

London.—PROPOSED "TUBE" EXTENSION TOWARDS ELSTREE.—The London Passenger Transport Board has deposited a Parliamentary Bill for the extension of the Morden-Edgware line for 2¾ miles towards Elstree. The project has been envisaged for some years, and much of the land required for the extension and for a proposed new rolling-stock depôt near Elstree to serve railway electrification schemes in North London has already been acquired. The extension would be mostly on the surface, and the cost, including rolling stock and land, would be about £750,000.

L.N.E.R.—RAILWAY ELECTRIFICATION PROGRESS.—The laying of the "live" rail in connection with the electrification of the L.N.E.R. line between Newcastle and South Shields has now been practically completed. Work is being started on the erection of sub-stations along the route. The route covers nine miles.

South Africa.—ELECTRIFICATION ACTIVITY.—According to the latest annual report of the South African Railways, there are 302 route- and 514 track-miles of line electrified in the Union. By 1938 these totals will have been increased to 551 route- and 1,050 track-miles. The report reveals that electricity obtained during the year from the Colenso steam-power station for the Natal main lines cost 0.583d. per kWh and that from the Salt River station for the Capetown suburban system cost 0.776d. per kWh.

RECENT WORK.—The electrification of the Durban to Cato Ridge main line has now been finished, but it is not expected that a full electric service will be instituted before the end of January.

Sussex.—FOX-HUNTING AND THIRD RAILS.—Following numerous complaints from Sussex and West Surrey fox-hunting organisations, whose hounds and beagle pups have been electrocuted on the railway, the Southern Railway has investigated the question of protecting the third rail on its electrified sections, and the general manager is reported to have informed one hunt that this would cost £400 a mile.

Communications

Algeria.—TELEPHONE NETWORK EXTENSION.—The Post and Telegraphs authorities are about to proceed with considerable extensions to the telephone system in the country, and tenders have recently been invited for the supply of 62½ miles of telephone cable with one pair of conductors.

France.—DIRECT TELEPHONE LINK WITH AMERICA.—*The Times* reports from New York that the first direct telephone link between America and France has just been inaugurated.

Great Britain.—RADIO RELAYS.—Arrangements have been concluded between the Relay Services Association and the Western Electric Co., Ltd., for the connection of a radio relay to the latter's cinema installations where this is desired by the cinema proprietor. R.C.A. Photophones already permit such connections to be made.

At September 30th last there were 235,691 radio-relay subscribers served by 347 stations. Seven towns had over 5,000 subscribers, and the percentage of relay listeners to total licences was 3.02. At September 30th, 1935, 213,977 subscribers were served by 338 stations and the percentage to total licences was 2.96.

PROFITABLE HULL TELEPHONES.—It was reported to the Hull Corporation Telephones Committee recently that whereas the estimated surplus for the current financial year was £19,200, in the first half of the year there was a surplus of £12,100, which was £2,000 more than for the similar period of the previous year. The manager (Mr. T. Holme) said it was hoped to pay for all capital extensions out of the profits if no money were taken for the relief of the rates. The city treasurer reminded the committee that royalties amounted to £13,000 a year.

Turkey.—POWERFUL NEW BROADCASTING STATION.—A *Reuter* message from Ankara states that Turkey is to have the most powerful broadcasting station of the Balkans and Near East. The Government has announced the invitation of tenders for the erection of the station, which will involve an approximate expenditure of £115,000 sterling. The station is to be built at Etimessoud, near the capital, and will be rated at 20 kW on the short waves and 60 kW on the long waves.

Telephone Developments in Lithuania

COMMUNICATION services form an important constituent of the programme of national development in Lithuania. A "Strowger" automatic telephone exchange was opened in the port of Klaipeda in December, 1935, and the cut-over of the Kaunas telephone system to automatic took place on October 24th last. The area of the capital at present has two exchanges, namely, the Kaunas main exchange, with 7,500 to 10,000 lines, and its satellite Sanciai, with 700 to 1,500 lines. The former will accommodate a second unit of 10,000 lines, for which provision has been made in designing the trunking scheme. The equipment at both is of the A.T.M. "Strowger" line-finder type, with 200-point, two-motion finder switches employing partial secondary trunking and is similar to that installed in the Klaipeda area. The design of the automatic equipment is based upon the practice of the British Post Office, and aims at providing the maximum economy in switch quantities consistent with the specified availability of trunks.

Only five toll selectors (10/10) are installed at the Kaunas exchange, due to the adoption of "Aviso" positions, the function of which is to complete toll calls. Each position has access to a full multiple of the local subscribers' lines, any of which can be connected on demand from the toll operator by means of plug-ended tie lines from the toll positions. Order wire working is used and the tie line is assigned by the "Aviso" operator. Once the connection is established the toll operator has full control until the clearing signal is given to the "Aviso" operator by taking down the connection on the toll position. Should the local line be engaged the toll operator receives a busy signal but can offer the toll call by operating a key. On acceptance he breaks down the local call and releases the automatic switches by operating a key and the toll call proceeds normally.

The principal advantages of "Aviso" working are in saving of time and automatic switches, and it is therefore used only during the busier hours. During the slack periods toll calls are completed over the automatic switch train, which affords toll offering and "forced release" facilities. It also gives a "busy-on-toll" tone so that the toll operator may not interrupt an established toll call.

Since inquiry, information, complaint and assistance (emergency) services and testing are centralised at Kaunas, no manual equipment is required at Sanciai.

The following power plant is provided at Kaunas: A 26-cell 1,500-2,000 Ah battery, two 23-cell 11 Ah meter batteries, power control board, engine driven 33-kW stand-by alternator, two motor generators with outputs of 210 A at 50 V and one with an output of 100 A at 50 V, and one supply-driven and one battery-driven ringing machine with outputs of 3 A at 75 V.

The power plant at the Sanciai exchange includes two 25-cell 240-420-Ah batteries, two 25-cell 11-Ah meter batteries, two 55-A 57-V motor generators and a power control board.

The whole of the equipment was designed, manufactured and installed to the specification of the Lithuanian Ministry of Communications by the Automatic Telephone & Electric Co., Ltd., in co-operation with the telephone staff of the Ministry.

Contract Information

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Contracts Open

Aberdeen.—December 18th. Town Council. Various stores, including electrical fittings. City Engineer's Office, Town House.

Abernethy (PERTHSHIRE).—Town Council. Electrical installations in twenty-four houses. L. A. Rolland, architect, High Street, Leven (deposit £1 1s.).

Abertillery.—December 31st. U.D.C. Meters and lamps. (See this issue.)

Bingley.—Electricity Department. Main and service joint boxes. (December 4th.)

Brightlingsea.—December 15th. U.D.C. Electrically driven pump, pipe lines, valves, &c., for the open air swimming bath. Surveyor, Town Hall.

Cardiff.—R.D.C. 1.869 yd. of 10,000-V cable. H. Jackson, electrical engineer, 20, Park Place (deposit £1 1s.).

Chiswick and Ealing.—December 22nd. Hospitals Committee. Electric wiring of new Maternity Hospital, Perivale. (See this issue.)

Cleethorpes.—December 14th. Borough Council. Cable, switchgear, rectifiers, complete with transformers, and remote control equipment. (November 27th.)

Conway and Colwyn Bay.—December 16th. Joint Water Supply Board. Booster plant, with all electrical equipment, &c., for augmenting pressure on a trunk main at Larn-y-Mynach, near Llandudno Junction. C. F. Farrington, engineer to the Board, Trinity Square, Llandudno (deposit £5 5s.).

Derby.—December 12th. Borough Council. Domestic apparatus control equipment. (December 4th.)

Durham.—County Council. Electrical installations at the new Mental Deficiency Colony, School Aycliffe, Heighington. Particulars from T. Taliesin Rees & R. Holt, architects, 64, Rodney Street, Liverpool, 1 (deposit £2 2s.), by December 12th.

Eastbourne.—January 14th. Electricity Committee. Stores for twelve months; wiring installations; and reconditioning of cookers, water heaters and wash boilers. (See this issue.)

Egypt.—CAIRO.—February 2nd. Ministry of Public Health. H.v. transmission line to the Fayoum drainage sewage purification works. (T.Y. 30977.)*

Great Yarmouth.—January 2nd. Borough Council. Cable. (See this issue.)

Grimsby.—December 19th. Corporation. One steam generating unit and ancillary plant. (December 4th.)

Hastings.—December 24th. Electricity Department. Kiosk with h.v. and l.v. control for transformer. (December 4th.)

Hendon.—December 29th. Corporation. Electrical installations in branch public library, open air swimming pool, maternity and child welfare centre, and school. (See this issue.)

Irish Free State.—DUBLIN.—December 21st. Dublin United Tramways Co. (1896), Ltd. General stores for twelve months, including cables, electric lamps and fittings. Company's offices, 59, Upper O'Connell Street (2s. 6d.).

ELECTRICITY SUPPLY BOARD.—January 8th. P.i. cables. (December 4th.)

Kettering.—December 23rd. U.D.C. Electricity Department. One 6-panel and one 5-panel duplicate bus-bar switchboards and two 3,000-kVA transformers. (November 27th.)

London.—LONDON AND HOME COUNTIES J.E.A.—December 19th. Rectifying plant at Twickenham. (December 4th.)

ISLINGTON.—January 13th. Borough Council. Electrical and engineers' stores for one year. (December 4th.)

January 1st. West of India Portuguese Guaranteed Railway Co. Five 3-ton electric level luffing wharf cranes. L. G. Bourchier, secretary, 4, Coleman Street, E.C.2 (deposit £1 not returnable).

Long Eaton.—December 15th. U.D.C. Electricity Department. Cable. (December 4th.)

Manchester.—December 19th. Electricity Committee. Pumps and coal-handling crane and grab. (December 4th.)

December 15th. Transport Committee. Steel traction poles and motor tower wagon. General manager, Transport Department, 55, Piccadilly.

Middlesbrough.—December 14th. Town Council. Electric goods lift for new workshops. Town clerk, Municipal Buildings (deposit £1 1s.).

Middlesex.—January 18th. County Council. Electrical installations at the new Technical Institute, Twickenham. (See this issue.)

Milford Haven.—December 30th. U.D.C. Electricity Committee. Cable, switchgear, transformers, rectifier, distribution gear and remote control supervisory gear. (December 4th.)

Morley.—December 15th. Housing Committee. Various works, including electrical, at fifty houses on the Baker Street estate. Borough engineer, Town Hall (deposit £2 2s.).

New Zealand.—WELLINGTON.—February 16th. Public Works Department. Four 5,000-kVA transformers. (T. 30943.)*

January 11th. Posts and Telegraph Department. Telephone cable. (T. 30975.)*

January 12th. Cadmium copper wire. (T. 30973.)*. Insulators. (T. 30974.)*

January 13th. Galvanised wire. (T. 30971.)*

January 20th. Insulated copper wire. (T.Y. 30972.)*

Northern Ireland.—BELFAST.—December 15th. Town Council. Two electrically driven horizontal centrifugal pumps (250-gal. per min. each), with cabling, switch- and control gear, for the Ormeau Avenue baths. City Surveyor's Department (Engineering Section), Room 94, City Hall.

December 14th. Electricity Committee. 33-kV, 3-phase, duplicate bus-bar, armourclad switchgear. (December 4th.)

Penybont.—December 14th. R.D.C. Overhead line materials. Electrical engineer, Electricity Department, Pyle, Glam.

Risca.—December 21st. U.D.C. Various goods, including electrical fittings and materials for six months. Electrical engineer, Gas Works.

Seaton Valley.—December 15th. U.D.C. Wiring ninety-eight houses on the Grange estate, Shiremoor. (December 4th.)

Solihull.—December 28th. U.D.C. Electrically driven, vertical spindle, centrifugal pumps, with motors, switchgear, electric wiring &c., for the Purnell's Brook sewerage, Knowle. R. Dunn, engineer and surveyor, Council Offices, Streetsbrook Road.

South Africa.—JOHANNESBURG.—December 12th. Municipality. Electricity meters. (T.Y. 30956.)*

Southampton.—Corporation. Diesel-electric pumping plant, consisting of engines, generators, motors, low and high lift pumps and auxiliary plant. J. Hawksley, waterworks engineer, Civic Centre (deposit £5 5s.).

South Shields.—December 22nd. Corporation. Cables. (See this issue.)

Staffordshire.—County Council. Electric lighting and power in the new Victoria Road Technical College, Stafford. (December 4th.)

Stone (STAFFS).—December 19th. U.D.C. Erection of an electrical transmission line at Cocknage. Electricity Department, High Street.

Sutherland.—January 9th. County Council. Electric lighting at twenty-two houses at Golspie, Bonarbridge and Embo. E. W. Brannon, architect to the local authority, Dornoch.

Wallasey.—December 15th. Borough Council. Cables, street lighting poles, bases, brackets and fittings. (See this issue.)

West Riding.—December 31st. County Council. Electric lighting and l.p. hot water apparatus at the extensions of the Hemsworth West End Council school and electric lighting at Wickersley new junior and infants' school. Education officer, County Hall, Wakefield.

York.—December 14th. Corporation. Electrically driven, vertical spindle, centrifugal pump at the sewage disposal works, Naburn. C. J. Minter, city engineer, Guildhall (deposit £1 1s.).

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* Further particulars from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Contracts Closed

Cardiff.—Estates Committee. Accepted. Telephone equipment at the Electricity Offices (£526).—J. B. Saunders, Ltd. Switchboard (£200) and switch panel (£138).—Whitehead Switchgear, Ltd. 800-kVA transformer (£403).—Met.-Vick. Elecl. Co. Switchgear at sub-stations: Waterloo Gardens (£285).—Ferguson, Pailin, Ltd. Park Lane (£343).—English Electric Co.

Coventry.—Electricity Committee. Accepted. Five 3-panel switchboards for sub-stations (£2,101).—Switchgear & Cowans.

Keighley.—Electricity Committee. Accepted. Erection of overhead line from Oldfield to Newsholme (£253).—Transmission Lines & Cable Construction Co.

Lanark.—County Council. Accepted. Electrical installations in sixty-four houses at Drumgray and Main Street, Greengairs (£468).—D. Henderson.

Leeds.—Electricity Committee. Accepted. Cables.—Enfield Cable Works (£7,413); Edison Swan Cables (£2,735); B.I. Cables (£2,428); Henley's (£1,966); Hackbridge Cable Co. (£860); Derby Cables (£1,215); Telegraph Const. and Maint. Co. (£442).

London.—CAMBERWELL.—Public Service Committee. Recommended. Furnace at crematorium (£1,500).—G.E.C.

L.C.C.—Housing and Public Health Committee. Recommended. Extension of the existing contract for wiring and fittings for electric lighting, &c., in blocks 2, 3 and 4 (part) of dwellings at Haggerston estate, Shoreditch, to include electrical installations in remainder of block 4 of the dwellings (£287).—J. L. Shadwell.

Liverpool.—City Council. Accepted. Transformers.—G.E.C. (£8,354): Met.-Vick. Elecl. Co. (£1,620); Electric Construction Co. (£1,980).

Electric Power and Lighting Committee. Recommended. Kiosks for static sub-stations for two years.—Met.-Vick. Elecl. Co.

Plymouth.—Electricity Committee. Accepted. Twelve months' supply of street disconnecting boxes.—G. P. Cosway.

Portsmouth.—Electricity Committee. Circulating water plant:

	10,000 gal. per min.	13,500 gal. per min.
	£	£
Mather and Platt Ltd. Accepted	2,331	**2,622**
W. H. Allen and Sons	2,317	—
Gwynnes Pumps Ltd.	1,998	2,539
Mirrlees Watson Co. Ltd.	1,946	—
Pulsometer Eng. Co. Ltd.	1,872	—
Worthington-Simpson Ltd....	1,864	—

Stirlingshire.—County Council. Accepted. Electric lighting in seventy houses at Cowie (£424).—T. Irvine.

Warrington.—Electricity Committee. Accepted. Switchgear (£825).—Ferguson, Pailin, Ltd.

Forthcoming Events

Institution of Electrical Engineers.—Thursday, December 17th. Institution, London, W.C.2. 6 p.m. "The Micro-Gap Switch." Prof. W. M. Thornton. "Restriking Voltage and its Import in Circuit-Breaker Operation." Messrs. H. Trenchman and K. J. R. Wilkinson.

North-Eastern Centre.—Monday, December 14th. Armstrong College, Newcastle-upon-Tyne. 6.15 p.m. "Lightning." Mr. B. L. Goodlet.

Western Centre.—Monday, December 14th. Merchant Venturers' Technical College, Bristol. 6 p.m. "The High-Pressure Mercury-Vapour Lamp in Public Lighting." Messrs. G. H. Wilson, E. L. Damant and J. M. Waldram.

East Midland Sub-Centre.—Tuesday, December 15th. The College, Loughborough. 6.45 p.m. Address by Mr. E. A. Reynolds.

North-Western Centre.—Tuesday, December 15th. Engineers' Club, Manchester. 7.15 p.m. Papers by Prof. W. M. Thornton and Messrs. H. Trencham and K. J. R. Wilkinson.

Tees-side Sub-Centre.—Tuesday, December 15th. Cleveland Technical Institute, Middlesbrough. 6.45 p.m. "The Effects of Impulse Voltages on Transformer Windings." Messrs. T. E. Allibone, D. B. McKenzie and F. R. Perry.

Northern Ireland Sub-Centre.—Wednesday, December 16th. Municipal College of Technology, Belfast. 7.30 p.m. Joint meeting with the Belfast Association of Engineers. Paper by Mr. B. L. Goodlet.

Sheffield Sub-Centre.—Wednesday, December 16th. Royal Victoria Hotel, Sheffield. 7.30 p.m. "High Tension Apparatus under Short Circuit Conditions." Mr. W. F. C. Cooper.

Irish Centre.—Thursday, December 17th. Trinity College, Dublin. 6 p.m. Paper by Mr. B. L. Goodlet.

West Wales (Swansea) Sub-Centre.—Thursday, December 17th. Technical College, Swansea. 6.30 p.m. Informal discussion on "Oscillography." To be opened by Messrs. R. G. Isaacs and R. Richards.

Association of Consulting Engineers.—Friday, December 11th. Annual dinner.

Junior Institution of Engineers.—Friday, December 11th. Royal Society of Arts, London, W.C. 7.30 p.m. Presidential address by Sir William J. Larke. Friday, December 18th. 39, Victoria Street, London, S.W.1. 7.30 p.m. Informal meeting. Discussion on "Economics in Relation to Engineering." To be opened by Mr. K. W. Willans.

Association of Mining Electrical Engineers *(South Wales Branch).*—Saturday, December 12th. South Wales Institute of Engineers, Cardiff. 6 p.m. Informal discussion on "H.M. Electrical Inspector's Report for 1935."

Birmingham Electric Club.—Monday, December 14th. Grand Hotel, Birmingham. 7 p.m. Annual general meeting.

Association of Supervising Electrical Engineers.—Tuesday, December 15th. E.L.M.A. Lighting Service Bureau, London, W.C.2. 7.15 p.m. "Development of Domestic Load in Relation to Tariffs." Mr. F. W. Purse.

Electrical Power Engineers' Association *(London Technical Group).*—Tuesday, December 15th. Caxton Hall, London, S.W.1. 7.15 p.m. "The Organisation of Showrooms and Sales." Mr. V. W. Dale.

Institution of Civil Engineers.—Tuesday, December 15th. Institution, London, S.W.1. 6 p.m. "The Second Stage Development of the Lochaber Water Power Scheme." Mr. A. H. Naylor. Friday, December 18th. Vernon-Harcourt Lecture.

Institution of Engineers and Shipbuilders in Scotland.—Tuesday, December 15th. Institution, Glasgow. 7.30 p.m. "Television." Prof. G. W. O. Howe.

Batti-Wallahs' Society.—Thursday, December 17th. Hotel Victoria, London. 12.30 for 12.55 p.m. Luncheon to Sir Philip Dawson, M.P.

Notes

E.A.W. Luncheon

Nearly seventy persons were present on Wednesday at an informal luncheon held by the Electrical Association for Women at the Prince's Restaurant, Piccadilly, London, for the purpose of congratulating Mr. and Mrs. Ernest E. Sharp on their recent marriage. Wishing them both every happiness and success, Miss Caroline Haslett, C.B.E., director of the Association, said that not everyone appreciated that for all his unassuming ways Mr. Sharp might be called one of the captains of industry. His splendid work, too, in connection with the Electrical Industries Benevolent Association was too little known. Mrs. Sharp, as Miss Veda Brice, had been of inestimable value to the E.A.W. in her capacity of first honorary secretary of the London Branch. On behalf of the Association Miss Haslett presented Mr. and Mrs. Sharp with a set of old English cut-glass glasses and water jug.

In thanking the members of the E.A.W. for their kind wishes and for their gift Mrs. Sharp, in her inimitable, witty manner, mentioned her recent trip to Newfoundland, Canada and the United States. She hoped to have an opportunity of telling the E.A.W. at a later date some of her experiences abroad. Mr. Sharp also expressed his thanks to Miss Haslett and the Association.

Off-peak Water Heating

The proportion of consumers of the Idaho Power Co. using electric water heaters is among the greatest in the United States, according to *Electrical West*. More than 500 of the 7,000 water heaters installed have been changed over to off-peak service controlled by carrier current and the number is to be increased to 1,200 early next year. At present the reduction in the peak demand on this account is 300 kW at one sub-station, but if all the water heaters could be changed over 4,200 kW would be released for other loads. Actually, 3,500 installations could be economically controlled by carrier currents and will be so as soon as tests on the first installation have been completed. The Idaho Co. is said to have more consumers cooking electrically than any company in America.

Welded Underframes

Underframes for thirty-five 12-ton covered goods wagons recently completed at the Carriage and Wagon Works of the L.M.S. Railway Company at Wolverton are almost entirely electrically welded in construction, the only riveting being that on parts which require renewal or removal, such as the axle guards. They are standard underframes, 17 ft. 6 in. long over the headstocks and 7 ft. 8 in. wide over the side rails, and the main members are identical with those used on the riveted wagon. The constructional members were sawn or milled to form a close abutment in the underframe, the meeting edges being chamfered where necessary. The cross-bars, longitudinals and drawbar cradle carriers were assembled in a jig, tack welded, welded properly, and then removed from the jig. This welded section and the whole of the remaining main members to be welded were next assembled in a large jig arranged to revolve on trunnions, so that the welds could be made horizontally as far as practicable. The welding currents varied from 175 A to 180 A, the fillet weld sizes being $\frac{1}{4}$ in., $\frac{5}{16}$ in. and $\frac{3}{8}$ in. A considerable saving in overall weight is an important result of the welding. One frame was subjected to an impact test which resulted in derailing, three axle boxes being broken and two bolt heads on the vee hanger being sheared off. There was no sign of joint failure.

Fatality

Dr. R. A. McCrea, the Chesterfield coroner, uttered a public warning for care in handling electrical appliances when holding an inquest on an 18-year-old youth. John Makin, who was found dead with an open pocket knife in one hand and an electric light bulb in the other. A length of flex was near him and another portion of wire was plugged into a switch which was turned off. The assumption was that the lad intended to join the two pieces of wire, the ends of which were bare. It was stated that the switch was of the usual single-pole type. Makin had been standing on a metal plate. A verdict of "Accidental death" was recorded.

Brighton Electrical Convention

According to the December number of the I.M.E.A. *Journal*, the Council of the Association is trying to arrange for the following subjects to be covered in the course of the proceedings of the Brighton Convention (May 31st to June 5th next): Managerial aspect of an electricity supply undertaking; the development of electricity supply in a rural district; and electric thermal storage.

Appointments Vacant

Boiler house junior shift engineers for Bristol Electricity Department.

Temporary senior assistant electrical engineer for the Government of Northern Ireland.

Plumber-Jointer for the Boston and District Electric Supply Co., Ltd.

Assistant engineer for the Government of Nigeria Posts and Telegraphs Department.

Borough electrical engineer for Barnstaple.

Assistant lady demonstrator for Cardiff Electricity Department.

Engineering assistant for Mid-Lincolnshire Electric Supply Co., Ltd.

Temporary installation engineer for Burnley Electricity Department.

Junior mains assistant for Southport Electricity Department.

Temporary street-lighting assistant for Swinton and Pendlebury Electricity Department.

Switchboard attendant for Basingstoke Electricity Department.

Technical officer at the Royal Aircraft Establishment, South Farnborough.

Electrical engineering assistants in the drawing office of the Air Ministry.

Overhead lines superintendent for Liverpool Transport Department.

(See our classified advertisements.)

Our Service Department

EVERY day inquiries of all kinds are received by the Editors, the bulk of them relating to the producers of specified classes of electrical goods. We are able to reply to most of these with the aid of our extensive records, but in a few cases we have to seek the assistance of our readers. This week we have been asked for the names and addresses of manufacturers of the following:—

HAMILTON-SAN MARGO electric clock.

Small hand-stamping machine to operate at 250 V for stamping the selvedge of fabrics by embossing through gold leaf.

We are also asked for the present addresses of the following concerns:—

STANDARD OZONE CO., LTD.

REGENT ILLUMINATING CO.

Readers should enclose stamped addressed envelopes when making their enquiries.

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Mr. J. E. Macfarlane, the author of the article on "Heating Curves of Motors," which appears on page 812, received his technical education at Brighton Technical College and served with the R.N.V.R. from 1914-1919. In 1920 he became a student apprentice with the English Electric Co., Ltd., at Stafford, and in 1922 he was appointed assistant designer at the company's Preston works. He became chief assistant designer at Newtons' Dynamo Works, Taunton, in 1925, and two years later was appointed chief designer to the re-organised concern Newtons of Taunton, Ltd.

[Elliott & Fry.

Mr. J. E. Macfarlane

He has had considerable teaching experience at the Harris Institute, Preston, and the L.C.C. Hackney Technical Institute, and is now a senior assistant in electrical engineering at the Northampton Polytechnic, E.C., mainly on electrical machine design.

Mr. Guy Campbell has joined the board of directors of Holophane, Ltd.

Mr. H. F. McLoughlin, whose portrait accompanies this note, is chairman and managing director of J. A. Crabtree & Co., Ltd., and is also on the board of the newly formed Crabtree Electrical Industries, Ltd., whose recent capital issue was largely oversubscribed.

Mr. H. F. McLoughlin

Mr. A. E. Jepson, assistant manager at the Manchester Branch of the General Electric Co., Ltd., has been appointed manager of the M.X.Y. Department in London. Mr. Jepson has been at Manchester for seven years, and previously was manager of the Sheffield Branch for ten years. **Mr. W. W. Wood,** manager of the M.X.Y. Department for the past two years, has taken up an important post with Pirelli-General at Magnet House, Kingsway.

The vacant position of assistant manager at Manchester has been filled by **Mr. A. G. Hawkins,** for many years general manager in Calcutta of the General Electric Co. (India), Ltd. Mr. Hawkins has been succeeded at Calcutta by **Mr. E. J. Warren,** manager of the Bombay Branch, and **Mr. A. J. Emery** has succeeded Mr. Warren at Bombay. **Mr. W. C. Parrott,** of the Edinburgh Branch, has been promoted to succeed the late Mr. J. R. Wilson as manager of that Branch.

Mr. H. J. Hills, of the staff of the Newhaven & Seaford Electricity Co., who was recently married to Miss M. W. Collington, has been presented by his colleagues with an electric clock in walnut case.

In our last issue we announced that **Mr. F. Polden,** M.I.E.E., M.I.Mech.E., managing director of Francis Polden & Co., Ltd., had been elected chairman of the Coronation Decorations and Illuminations Committee for the City of London, and we now reproduce his portrait. Our readers will recall that in April of this year Mr. Polden was appointed by the Court of Common Council of the City Corporation as its representative on the London and Home Counties Joint Electricity Authority.

Mr. F. Polden

Ald. H. K. Beale was reappointed chairman of the South-West Midlands Advisory Joint Committee at a meeting held on December 8th.

Mr. J. Downie, chief clerk of the Aberdeen Corporation Electricity Department, has retired after nearly forty years' service. He has been presented with a wallet of notes from his fellow employés, together with a handbag for Mrs. Downie.

Mr. W. J. Hadfield, borough electrical engineer at Barnstaple, has tendered his resignation, to take effect on March 31st next.

Mr. L. C. Sharp, of Venner Time Switches, Ltd., was elected a member of Malden and Coombe Borough Council at a recent by-election.

Obituary

Mr. Joseph Owen, whose death is announced at the age of fifty-four years, had for upwards of twenty years been chief electrician with Ward & Goldstone, Ltd., of Pendleton, Salford.

Mr. J. Aldworth.—The funeral took place on Friday last of Mr. John Aldworth, general manager of the Nottingham Corporation Tramways from 1898 to 1929, who died earlier in the week at the age of eighty-one years.

Mr. W. J. Targett.—The death occurred recently at Winterbourne Dauntsey, Salisbury, after a short illness, of Mr. Walter Jeffery Targett, who was formerly with the London Electric Supply Corporation, Ltd. He was sixty-nine years of age.

Electrical men of an older generation will note with regret that **Mrs. Elizabeth Mary Pym,** wife of the late Captain H. Riall Sankey, C.B., C.B.E., R.E., died on December 7th, at Ealing, at the age of eighty-five years.

Mr. A. Forbes Dick, who was formerly with Boulton & Paul, Ltd., died on Wednesday last. The funeral is at Golders Green Crematorium at 12.15 p.m. to-day (Friday).

Will.—Major-General Sir Newton James Moore, a director of the General Electric Co., Ltd., and of a number of other companies, left £61,083, with net personalty £48,713.

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

Franklin Lamp Manufacturing Co., Ltd.—Private company. Registered December 4th. Capital, £1,000. Objects: To carry on the business of manufacturers of and dealers in lamps, lamp shades, globes and brackets, and electrical and gas fittings of all kinds, &c. The subscribers are: A. M. Coney, 7, East Banks, Sleaford, and J. H. Wright, 60, London Road, Sleaford. Wm. F. B. Johnson is permanent director and chairman. So long as the Franklin Lamp Manufacturing Co., Inc. (Pennsylvania), holds £100 shares it may appoint one director. Solicitors: Ernest H. Godson & Co., Sleaford.

Deansbrook Electrical Co., Ltd.—Private company. Registered December 4th. Capital, £200. Objects: To carry on the business of manufacturers of electrical appliances, heating, refrigerating and air-conditioning apparatus, electrical, mechanical and general engineers, &c. The directors are: L. E. C. Simpson, 132, Woodcote Road, Purley, and J. A. Clark, 1, Arlow Road, Winchmore Hill, N.21.

Robert Terrell & Sons, Ltd.—Private company. Registered December 3rd. Capital, £100. Objects: To acquire the business of manufacturers of and dealers in electrical and wireless apparatus, appliances, &c. The directors are: R. Terrell and C. Terrell, both of 24, Queen's Avenue, Muswell Hill, N.10. Registered office: Aldwych House, Aldwych, W.C.2.

Evco, Ltd.—Private company. Registered December 4th, in Edinburgh. Capital, £500. Objects: To carry on the business of dealers in electric vehicles, cars, batteries, electrical and mechanical equipment and accessories, spares, tyres and bodies, &c. The directors are: A. M. Cousins, 1, Pitcullen Terrace, Perth, and R. Ferguson, 3, Kinnoull Street, Perth. Registered office: 3, Kinnoull Street, Perth.

Electronaire Marketing Co., Ltd.—Private company. Registered November 30th. Capital, £20,000. Objects: To carry on the business of manufacturers of and dealers in vacuum cleaners and sweepers, electrical machines and contrivances of household utility, electrical engineers and contractors, &c. The subscribers are: P. A. J. Baker, Dial Cottage, Cookham

Road, Maidenhead; and V. Hudson, Frogwell, Ardleigh Green Road, Hornchurch. Solicitors: P. W. Bullock, 7, Stone Buildings, Lincoln's Inn, W.C.2.

Rentals R.A.P., Ltd.—Private company. Registered December 5th. Capital, £100. Objects: To carry on the business of manufacturers and distributors of and dealers in radio, electrical and television instruments, &c. The directors are: Wm. H. Berriedale Johnson and Mrs. B. Berriedale Johnson, both of "Thornhill," St. Mary's Road, Long Ditton, Surrey. Registered office: Ferry Works, Summer Road, Thames Ditton.

Certus Appliances, Ltd.—Private company. Registered November 30th. Capital, £500. Objects: To carry on the business of manufacturers of and dealers in gas, electrical and other cookers, burners, radiators, fires, &c. The directors are: J. H. Wilson (permanent), Mill House, Bagington, Warwickshire; and W. D. Wilson, Greenhayes, Armorial Road, Coventry. Solicitors: Sidney F. Snape & Co., Coventry.

Blitz Bros., Ltd.—Private company. Registered December 1st. Capital, £1,000. Objects: To carry on the business of general factors, dealers in wireless, television, musical and electrical instruments, accessories, &c. The life directors are: M. Blitz, 7, Shaa Road, East Acton; and S. Blitz, 57, Grafton Road, Acton. Registered office: 7, Shaa Road, East Acton, W.3.

E. S. Archdale (Leeds), Ltd.—Private company. Registered December 2nd. Capital, £1,500. Objects: To carry on the business of electrical, mechanical and automobile engineers, &c. The directors are: E. S. Archdale, 31, Clarendon Road, Leeds, and two others. Registered office: 19 and 21, Somers Street, Leeds.

Neon Tube-Lights (Finsbury), Ltd.—Public company. Registered November 30th. Nominal capital, £10,000 in 400,000 ordinary shares of 5s. each. Objects: To carry on the business of manufacturers of neon electric signs and to acquire the business, plant and machinery of Francis Tube-Lights, Ltd. The first directors are: J. D. Harper, 4, Hook Heath, Woking, and L. F. Mitchell and S. A. Mitchell, both of 209, Isledon Road, N.7. Registered office: 129, Minories, E.C.3.

South Coast Sales, Ltd.—Private company. Registered December 3rd. Capital, £100. Objects: To carry on the business of sellers of vacuum cleaners, refrigerators, water softeners, general electrical equipment and domestic appliances, &c. The directors are: S. Balister, Mrs. D. Stuart-William, and Mrs. H. D. M. Balister, all of 20, Grove Road, Worthing. Registered office: 33, West Street, Brighton.

A. W. Magennis, Ltd.—Private company. Registered in Dublin on November 21st. Capital, £100. Objects: To carry on the business of manufacturers of and dealers in machines for hairdressers, electricians, electrical and mechanical engineers, &c. The directors are: A. W. Magennis (chairman), and Mrs. E. Magennis, both of Vico House, Vico Road, Killiney, and P. Keeley, 53, Middle Abbey Street, Dublin.

Jameson's Radio, Ltd.—Private company. Registered November 25th. Capital, £100. Objects: To acquire the business of wireless and electrical dealers carried on by Jamesons at 124, Notting Hill Gate, W.11. The subscribers are: Sadie Birnbaum, 34, Havering Street, Stepney, E.1, and A. Green, 82, Wrottesley Road, N.W.10. Registered office: 35, Great Russell Street, W.C.1.

Great West Radio Service, Ltd.—Private company. Registered November 28th. Objects: To carry on the business of manufacturers of and dealers in radio, electrical and television instruments and apparatus, &c. The directors are: F. R. Hall, 21, Hillingdon Road, Uxbridge, and N. Osborne, 3, Pages Hill, Muswell Hill, N. Secretary. W. P. Aveling. Registered office: Goodwins Estate Office, 210, Gt. West Road, Hounslow West, Middlesex.

T.D. (Subsidiary), Ltd.—Public company. Registered November 28th. Nominal capital, £100. Objects: To carry on business as telephone, radio, and television instrument makers, dealers in telephones and cables, wires, accumulators and lamps, makers of instruments for the deaf, manufacturers, installers and repairers of and dealers in systems and installations used for synchronising or distributing time master and secondary clocks, dials, batteries, alternators, dynamos and wiring, &c. The subscribers are: J. H. Whittaker, 7, Waterloo Road, Waterloo, Huddersfield, K. Turner, Park View, Thongsbridge, Huddersfield, solicitor, and five others. Registered office: Dictograph Works, Aurelia Road, Croydon.

S.D. Cookers, Ltd.—Private company. Registered November 21st. Capital, £100. Objects: To carry on the business of manufacturers of and dealers in cooking apparatus of all kinds, &c. The directors are: Mrs. M. L. Davys, 3, Granville Place, W.1, and two others. Registered office: Columbia House, Aldwych, W.C.2.

Returns of Electrical Companies

Smith Bros. (Caer Conan) Wholesale, Ltd.—Capital, £1,000 in £1 shares. Return dated August 10th, 1936. All shares taken up. £1,000 paid. Mortgages and charges nil.

Brasse, Ltd.—H. A. Deed, C.A., of 97 and 99, Cheapside, E.C., was appointed receiver on November 10th, 1936, under powers contained in debenture dated February 12th, 1931, in place of E. Stone, who ceased to act as receiver and manager on the above-mentioned date.

Milford-on-Sea Electric Supply Co., Ltd.—Satisfaction to the extent of £1,900 on March 31st, 1936, of debentures authorised by resolutions of September 3rd, 1904, and April 29th, 1921, and registered November 28th, 1904, and July 16th, 1921, respectively. Notice filed November 10th, 1936.

Radiographic, Ltd.—Particulars filed of £900, debentures, authorised October 30th, 1936, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Electrical Finance and Securities Co., Ltd.—Satisfaction to the extent of £5,081 on October 31st, 1936, of trust deeds dated July 29th, 1927, and July 6th, 1928, April 24th, 1930, and January 29th, 1932, and registered July 29th, 1927, July 10th, 1928, April 29th, 1930, and February 1st, 1932, respectively.

R. Darbyshire, Ltd.—Equitable charge on certain hire-purchase agreements, full benefit thereof, and of all securities therefor and all moneys payable thereunder, dated October 29th, 1936, to secure all moneys due or to become due from the company to Martins Bank, Ltd., not exceeding £1,000.

London Power Co., Ltd.—£1,000,000 debentures (part of a series already registered) were issued on November 6th, 1936, at 100½ per cent. less 5s. per cent. commission.

McCartney, Milroy & Co., Ltd.—Satisfaction to the extent of £5,000 between December 8th, 1931, and July 6th, 1936, of debentures authorised July 6th, 1923, and registered July 24th, 1933. Notice filed November 20th, 1936. (According to the register of mortgages, the debentures registered July 24th, 1923, originally secured £15,000.)

Little Lever Radio Relay Co., Ltd.—Capital, £500 in 500 shares of £1. Return dated September 16th, 1936. 300 shares taken up. £300 paid. Mortgages and charges, nil.

Thorn Electrical Industries, Ltd.—The nominal capital has been increased by the addition of £148,000 beyond the registered capital of £2,000. The additional capital is divided into 50,000 6 per cent. cumulative preference shares of £1 and 392,000 ordinary shares of 5s. Each of the existing £1 shares has been sub-divided into 4 shares of 5s.

Altrincham Electric Supply, Ltd.—The nominal capital has been increased by the addition of £100,000 beyond the registered capital of £210,000. The additional capital is divided into 50,000 cumulative participating ordinary shares of £1 each, and 1,000,000 deferred shares of 1s. each. The new deferred shares, with 140,000 deferred shares in the original capital, have been consolidated into 228,000 deferred shares of 5s. each.

Engineering Products, Ltd.—Satisfaction to the extent of £1,100 and interest on November 25th, 1936, of three debentures dated July 27th, August 17th, and September 26th, 1935, and registered August 16th, August 27th, and October 5th, 1935.

Ceará Tramway Light & Power Co., Ltd.—Particulars filed of debenture stock to secure £50,000 (inclusive of £3,000 already issued), authorised by resolutions of May 8th, 1935, and November 17th, 1936, and covered by trust deed dated November 17th, 1936 (supplemental to trust deed dated July 31st, 1935), charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £20,000. Trustees: Union Commercial Investment Company, Ltd.

Portman Electrical Engineering Co., Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated November 25th, 1936, to secure £500. Holders: Geo. Northcroft, 115, Harley Street, W.

H. O. Electrical Manufacturing Co., Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated November 24th, 1936, to secure £100. Holders: S. H. Elford and C. F. Kingsley, both of Tower Works, Clapham, S.W.4.

Musselburgh and District Electric Light Traction Co., Ltd.—Satisfaction to the extent of £1,500 on November 25th, 1936, of 5 per cent. debentures authorised by resolutions of November 13th, 1905, and April 8th, 1909, and registered May 12th, 1909, securing £90,000.

Mead & Jeffery, Ltd.—Charge on land and premises No. 23, The Avenue, Ealing, dated November 10th, 1936, to secure £500. Holders: Lewis G. Chapman, Imperial Hotel, Russell Square, W.C., and Miss Rose Chapman, 110, Greencroft Gardens, Kilburn.

Rural Electricity Supply Co., Ltd.—Capital, £10,000 in 9,500 preferred shares of £1 and 10,000 deferred shares of 1s. Return dated October 23rd, 1936. 5,512 preference and 5,713 deferred shares taken up. £3,156 13s. paid on 2,871 preference and 5,713 deferred shares. £2,641 considered as paid on 2,641 preference shares. Mortgages and charges, nil.

Anglo-Argentine Tramways Co., Ltd.—Capital, £11,000,000 in 800,000 1st preference and 710,000 2nd preference shares of £5 and 862,500 ordinary shares of £4. Return dated July 28th, 1936. 640,000 1st preference, 610,000 2nd preference and 675,000 ordinary shares taken up. £850,000 paid on 20,000 1st preference and 150,000 ordinary shares. £8,100,000 considered as paid on the remainder. Mortgages and charges: £70,660 annuity, £4,465,674 4 per cent. debenture stock, £1,733,380 4½ per cent. debenture stock, and £6,000,000 6 per cent. debenture stock.

Electric and General Investment Co., Ltd.—Capital, £201,500 in £60,000 ordinary stock and 141,500 ordinary shares of £1. Return dated July 14th, 1936. £60,000 ordinary stock taken up. £22,000 paid. £38,000 considered as paid. Mortgages and charges, £98,500.

Wickford and District Electricity Supply Co., Ltd.—Capital, £30,000 in 1,500 7 per cent. preference and 28,500 ordinary shares of £1. Return dated March 31st (filed October 30th), 1936. 1,500 preference and 16,500 ordinary shares taken up. £17,995 paid. Mortgages and charges, nil.

Wm. G. Walter (Bath), Ltd.—Mortgage on land and Old Bath Prison, Twerton, Bath, dated November 16th, 1936, to secure £500. Holder: W. J. Sims, Highways, Batheaston, Bath.

Pearce Signs, Ltd.—The nominal capital has been increased by the addition of £7,300 in £1 ordinary shares beyond the registered capital of £2,700.

Express Radio Factors, Ltd.—Capital, £2,500 in £1 shares. Return dated September 18th, 1936. All shares taken up. £2,500 paid. Mortgages and charges, nil.

Radio Relays, Ltd.—Capital, £7,500 in 6,750 10 per cent. cumulative preference shares of £1 and 15,000 ordinary shares of 1s. Return dated August 12th, 1936. All shares taken up. £7,500 paid. Mortgages and charges, nil.

Sellers of Leeds, Ltd.—Capital, £12,000 in 4,000 preference and 8,000 ordinary shares of £1. Return dated October 27th, 1936. 3,000 preference and 5,000 ordinary shares taken up. £2 paid. £7,998 considered as paid. Mortgages and charges, nil.

Invicta Electrodes, Ltd.—The nominal capital has been increased by the addition of £15.000 in £1 ordinary shares beyond the registered capital of £10,000.

Philco Distributors (Lancashire), Ltd.—Capital, £5,000 in 5,000 shares of £1. Return dated June 29th (filed September 2nd), 1936. 2,500 shares taken up. £2,500 paid. Mortgages and charges nil.

Neon Hire & Supply Co., Ltd.—Capital, £1,500 in 25,000 ordinary shares of 1s. and 250 preference shares of £1. Return dated July 17th, 1936. All shares taken up. £1,250 paid on 20,000 ordinary and 250 preference shares, £250 considered as paid on 5,000 ordinary shares. Mortgages and charges: £500.

Gardner & Co. (Portsmouth), Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1935 (filed September 2nd, 1936). 902 shares taken up. £2 paid, £900 considered as paid. Mortgages and charges, nil.

Precision Moulders, Ltd.—Debenture, charged on the company's undertaking and property, present and future, including uncalled capital, dated November 16th, 1936, to secure £1,000. Holder: A. Freedman, 21, Fairhazel Gardens, West Hampstead, N.W.6.

Whiteway Lighting, Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated November 25th, 1936, to secure all moneys due or to become due from the company to British Linen Bank.

Perkins Radio Service, Ltd.—The nominal capital has been increased by the addition of £100 beyond the registered capital of £2,000. The additional capital is divided into 2,000 "A" shares of 1s.

Technical Lights & Equipment Co., Ltd.—Capital, £2,500 in £1 shares. Return dated November 16th, 1936. 2,300 shares taken up. £1.120 paid, £1,180 considered as paid. Mortgages and charges nil.

General Resistors, Ltd.—Capital, £3.000 in 3,000 preference and 5.000 ordinary shares of £1. Return dated October 29th, 1936. 3,452 ordinary and 2,789 preference shares taken up. £6,239 paid, £2 calls unpaid. Mortages and charges nil.

Stokes Appliances, Ltd.—Capital, £5,000 in £1 shares. Return dated July 3rd, 1936. 403 shares taken up. £403 paid. Mortgages and charges nil.

Rediffusion, Ltd.—Capital, £10,000 in £1 shares. Return dated July 16th, 1936. All shares taken up. £10,000 paid. Mortgages and charges nil.

Pennington, Stevens & Taylor, Ltd.—Capital, £7,000 in £1 shares. Return dated August 3rd, 1936. 6,912 shares taken up. £6,762 paid, £150 considered as paid. Mortgages and charges nil.

City Notes

The Ceara Tramway, Light & Power Co. reports a net sterling revenue for the year ended June 30th of £19,768, as compared with £14,725 in the preceding year. The prior lien and first debenture stocks absorb £15,177 and £11,500 is placed to reserve for depreciation, reducing the balance carried forward from £11,136 to £4,227. The report states that in nearly all departments an increase in gross receipts was shown, but the benefit of such increase was largely counteracted by a rise in the cost of operation and loss in exchange. During the past ten years the company has expended on extensions and improvements over £100,000. If, however, the results of the past year's working are compared with those of ten years previously it is found that the sterling profits have fallen over 30 per cent., so that there has not only been no return upon the additional capital employed, but the earnings upon the original capital invested in the business have fallen in the period. A further £20.000 of prior lien stock, covering the balance of the authorised issue, is being made in order to cover expenditure already incurred on additions to the installation. It is hoped that with the completion of the work now in hand the necessity for extraordinary capital expenditure for the next few years will have been satisfied.

The India Rubber, Gutta Percha and Telegraph Works Co., Ltd., reports net profits for the year ended September 30th last of £66.137, as compared with £51.186 for 1934-35, when provision was made for the residue of expenses and losses arising from the Persian liquidation. The dividend on the preferred ordinary shares for the year is 8 per cent. (against 6 per cent.), and on the ordinary shares 9 per cent. (against 6 per cent.). Reserve for contingencies receives £25.000, and the balance carried forward is £16.126. The report states that the work on the building and re-equipment of several departments at Silvertown has made satisfactory progress. The complete programme is being pressed forward, but it will necessarily continue throughout 1937. Meeting December 11th.

Broom & Wade, Ltd., held their annual meeting on December 8th, when Mr. H. S. Broom (chairman and managing director) said that the company had had a successful year. Its capital had been increased for the purpose of acquiring the whole of the capital of B. E. N. Patents, Ltd., and this company had also had a satisfactory year. The turnover during the year reached a record figure, and considerable expansion of business had been achieved, both in the home market and overseas, particularly in the Dominions.

The British Vacuum Cleaner & Engineering Co., Ltd., reports a net profit for the year ended September 30th of £75,230, as compared with £60,769 in the previous year. With £11,722 brought in this makes £86,953 available. Tax reserve receives £11,664 and general reserve £20,000. The final ordinary dividend is 30 per cent., making 40 per cent. for the year, and £12,153 is carried forward. For the previous year the dividend was 66⅔ per cent., plus a capital bonus of 233⅓ per cent.

The Amazon Telegraph Co., Ltd., reports a gross revenue, including a profit of £1,415 realised on investments sold, of £14,887. Expenses totalled £25,148, leaving a loss of £10,261, and after charging £583 for income tax the deficit is £10,844, which is deducted from a balance of £16,455 brought in, leaving £5,611 to be carried forward. The report states that the loss for the year would not have arisen had the Bill for prorogation of the subsidy become operative in time to permit of the inclusion of the subsidy in the accounts.

Telephone Properties, Ltd., has declared the usual half-yearly dividend of 4 per cent. actual on the 8 per cent. preference stock, but in view of tariff negotiations now proceeding in Venezuela, it is proposed to postpone consideration of a dividend on the ordinary stock for 1936 until the accounts for the complete year are available.

The Associated Equipment Co., Ltd., held its annual meeting on December 7th, when Mr. C. W. Reeve (chairman) said that the company was now stronger than ever, in spite of extremely severe competition. During the year the most significant feature of the company's progress was the A.E.C. trolley-bus, and they were responsible for no mean proportion of the total number now employed in this country.

Ismay Industries, Ltd.—The directors announce that in order to finance expanding interests they have decided to issue 408,000 ordinary 5s. shares at 7s. 6d. per share, and to offer them to existing shareholders in the ratio of one new share for every five held.

Crabtree Electrical Industries, Ltd.—Lists in connection with the offer for sale by Dawnay Day & Co., Ltd., of 350,000 5 per cent. cumulative preference shares of £1 each and 840,000 ordinary shares of 10s. each of Crabtree Electrical Industries, Ltd., which were opened on December 2nd were closed almost immediately, being oversubscribed.

The General Cable Manufacturing Co. reports a net profit for the year ended September 30th last of £19,074, as compared with £18,464 for 1934-35. The final ordinary dividend is 5 per cent., maintaining the distribution for the year at 10 per cent., and £1,248 is carried forward.

Herbert Morris, Ltd., have announced an interim ordinary dividend of 2½ per cent., tax free, on capital as increased by the capital bonus of one in three. The dividend a year ago was 5 per cent., tax free, on smaller capital.

Electric and Musical Industries, Ltd., has acquired the whole of the share capital of Rudge-Whitworth, Ltd. Mr. A. J. Denniss, vice-chairman and managing director of Rudge-Whitworth, has entered into a new agreement whereby he will continue to manage the company's business.

The Mid-Southern Utility Co. is offering for sale by tender £50,000 4 per cent. consolidated preference stock at the minimum price of £105 per cent.

Yorktown (Camberley) & District Gas & Electricity Co.—A majority interest in this company has been acquired by Associated Gas & Water Undertakings, Ltd.

E. K. Cole, Ltd., are maintaining the interim dividend on the ordinary shares at 12½ per cent., actual, less tax.

Stocks and Shares

TUESDAY EVENING.

THE relations between the King and Mrs. Simpson have formed the subject of so much public interest that they have overshadowed all other considerations in the Stock Exchange, as in other directions. While what was called the crisis stood at its height, business in the Stock Exchange came to something like a standstill. Suspense and uncertainty are the two principal factors which militate against the desire to take any hand in the markets, either on the part of investment or speculation. As is common in such circumstances, the disposition of prices leaned towards lower levels, for the simple reason that buying power became sensibly diminished; while, on the other hand, nervous holders of stocks and shares endeavoured to lessen their commitments. There is always an automatic amount of selling which takes place day by day on behalf of deceased accounts, &c., and which normally is counteracted by purchases on behalf of people who wish to employ money in stocks and shares. The former goes on continuously. The buying may be, and in difficult times is, affected by considerations of caution, the result being, of course, that quotations give way under what is frequently a very moderate amount of selling.

These are factors which have been at work during the past business week. The latest developments led to a pronounced measure of relief, with a consequent recovery in many of the prices which had been previously depressed, though the full amount of the fall has not been recovered. In such shares as those where anything like a speculative account exists, fluctuations were fairly wide. Crompton Parkinsons make an apt illustration. From 79s., the price dropped to 73s., rallying thence to 77s. 6d.

Gilt-edged Securities

Apart from any extraordinary happenings at home and abroad, this is the season of the year when the prices of gilt-edged stocks usually feel the influence of money being re-

quired for window-dressing, manufacturers' taxes and other demands which tend to restrain the hand of investment, British Government stocks have gone back, this time, on fears of political complications. Other gilt-edged securities are not so easy to sell at good prices as they have been lately. Central Electricity, London Passenger Transport and fixed-interest issues of most kinds are duller in tendency. Falls are insignificant, but the market reflects in its general tone the cautious attitude of that class of capital which puts safety above all other considerations.

Supply and Equipment Shares

Prices in the markets for electricity supply and equipment have, during the week, shared the general tendency to sag under pressure of uncertainty. Crompton Parkinsons, as mentioned above, proved to be especially vulnerable, the prevailing malaise being augmented in this case by further selling on behalf of those who had been over-bullish in their expectations from what most people regard as excellent figures in the annual report. Cable shares generally put up a stout resistance to prevailing conditions. British Insulated, Callenders and Siemens all succeeded in making headway. Johnson and Phillips, however, slipped back to 47s. 6d., and Enfields yielded £5 1/16 to £5 1/8. General Electrics fell 2s. to 91s., and Associated Electricals 1s. 6d. to 50s. 6d. Others to lose ground were Switchgear and Cowans, now 18s. 3d., Chloride Electrical Storage 92s. 6d., Laurence Scott "A" 11s. 6d., and Reyrolles 78s.

The list of electricity supply shares shows a number of sixpenny losses, with more marked declines in Edmundsons, at 44s., North-Easterns 32s., British Power and Light 30s. 3d., and one or two others. The foreign section is notable for flatness in Palestine "A" shares at 45s.

Crabtree Industries

There was never any serious doubt of the reception which would be accorded to the new Crabtree Electrical Industries issue; even so, applicants for up to 3,000 ordinary or 1,000 preference shares could scarcely fail to be surprised that the public response was so overwhelming as to preclude their being allotted anything at all. No one, in fact, no matter how large his requirements, received more than 100 ordinary. Letters of acceptance or regret were in the hands of applicants last week-end, and animated business started in the shares early on Monday morning. The price of the 10s. ordinary shares, which were offered at 12s. 9d., opened in the market at about 18s., but was quickly swept up to 24s., on a wave of determined buying. Few issues of recent date have been received with such enthusiasm; the measure of success is all the more remarkable for having been achieved in drab and listless surroundings. The 5 per cent. preference, which came out at 20s. 6d., are now standing at 22s.

Ever Ready and Lissen

The terms of the Ever Ready Company's offer to holders of Lissen 8 per cent. preference shares had the effect of advancing the price of the latter to 22s. 6d., or half a crown higher than it stood before the announcement. The rise is natural. The offer is of four Ever Ready 5s. ordinary shares for five of the £1 Lissen preference units, so that, with the price of the former at 30s., Ever Ready is bidding little less than 24s. for the latter.

The price of Ever Ready units remains unmoved, although the circular intimating the scheme for complete unification of the two concerns gives another prop to hopes, stimulated by this year's increased interim dividend, of a total distribution, at the end of this year, exceeding the previous 35 per cent. The company's stipulation that the offer holds good only if an adequate response is made ensures that the action of Lissen stockholders will be watched with interested attention.

Walsall Conduits

The 4s. ordinary shares of this company were offered at 32s. 6d., and, after commanding a modest premium for a day or two, went back to 31s. 6d. It was inevitable that comparison should be made between these and the 10s. ordinary shares of Crabtree Electrical Industries, which came out at 12s. 9d. Walsall Conduits 5 per cent. preference attracted investment and rose to 21s. 9d.

Miscellaneous Matters

It is suggested that weakness in the price of London Transport "C" stock, which is now no better than 95, may have been exaggerated by uncertainty regarding the Board's anticipated activity during next season's celebrations. British Electric Traction issues are sympathetically dull, the deferred having repeated the previous week's loss of 50 points, and the preferred being a further 3 points down at 174½.

Cable and Wireless stocks sagged further, in the absence of any heartening news in the international sphere. The preference is now only a point over par. Globe Telegraph ordinary and preference each lost ⅛ to 14 and 14¼ respectively. American Telephone and Telegraph gained 2 points to 192½, but Internationals, 12½, and Western Unions, 90, are easier. American markets are subdued by uncertainties both internal and external; animation is noticeably lacking. With the price of rubber standing over 9d. per lb., rubber shares show restrained cheerfulness. The market gives the impression that, under more normal conditions, active dealings, at rising prices, might be in progress.

Share List of Electrical Companies

	Nom.	Dividend. Previous.	Dividend. Last.	Price. Dec. 8.	Rise or Fall.	Yield p.c. £ s. d.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	15	15	77/6	—	3 17 5
City of London	1	7½	7½	36/6	−6d.	4 2 1
Clyde Valley	1	7	8	45/6	—	3 9 7
County of London	1	10½	10½	53/6	−6d.	3 18 6
Edmundson's 7% Pref.	1	7	7	36/–	—	3 17 9
Do. Ord.	1	8	8	44/–	−1/–	3 12 9
Elec. Dis. Yorkshire	1	9	9	45/–	−1/–	4 0 0
Elec. Fin. and Securities	1	12½	12½	3 1/16	−1/16	4 1 7
Elec. Supply Corporation	1	11	11	58/3	—	3 15 7
Lancs Light and Power	1	7½	7½	38/–	−6d.	3 19 0
Lond. Assoc. Electric	1	—	7	35/–	—	4 0 0
London Electric	1	7	8	40/–	—	4 0 0
London Power Deb. Red.	Stock	5	5	107½	—	4 13 9
Metropolitan	1	10	10	50/–	−6d.	4 0 0
Midland Counties	1	7	7½	39/6	−6d.	3 16 0
Mid. Elec. Power	1	8	8	41/3	—	3 17 7
North Eastern Electric Ordinary	1	6	6	32/–	−1/–	3 15 0
Do. 7% Pref.	1	7	7	35/–	−1/–	4 0 0
Northampton	1	10	10	51/3	—	3 18 2
Notting Hill 6% Pref.	10	6	6	14½	—	4 4 3
North Met. Elec. Ordinary	1	10	10	55/–	—	3 12 9
Do. do. 6% Pref.	1	6	6	32/–	—	3 15 0
Scottish Power	1	8	8	41/–	—	3 18 2
South London	1	7	7	34/6	—	4 1 2
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	21/6	−2/–	6 19 8
Yorkshire Elec.	1	8	8	44/–	—	3 12 9
PUBLIC BOARDS.						
Central Electricity, 1950–70	Stock	5	5	120	—	4 3 5
Do. 1955–75	„	5	5	122	—	4 2 0
Do. 1951–73	„	4½	4½	113xd	—	3 19 8
Do. 1963–93	„	—	3½	104	—	3 7 4
London Elec. Trans. Gtd.	„	—	2½	94½	—	2 13 0
London & Home Counties, 1955–75	„	4½	4½	116	—	3 17 7
London Passenger Transport, A	„	—	4½	125	—	3 12 0
Do. do. B	„	—	5	125½	−1½	3 19 9
Do. do. C	„	3½	4	95	−1	4 4 4
West Midlands Joint Elec. 1948–68	„	—	5	116½	—	4 5 10
TELEGRAPH AND TELEPHONE.						
American Tel. & Tel.	$100	9	9	192½	+2	4 13 6
Anglo-Am. Tel. Pref.	Stock	6	6	129½	—	4 12 8
Do. Def.	„	1½	1½	31	—	4 16 9
Cable & Wireless 5½% Pref.	„	4½	5½	101	−½	5 9 0
Do. A. 7½% Ord.	„	Nil	Nil	18¾	−¼	—
Do. B. Ord.	„	Nil	Nil	6	−⅛	—
Globe Tel. & Tel. Ord.	10	3½*	4½*	14	−2/6	3 4 3
Do. Do. Pref.	10	6	6	14½	−⅛	4 4 6
Great Northern Tel.	10	20	20	47	—	4 5 1
Marconi-Marine	1	10	7½	36/9	—	4 1 8
Oriental Telephone Ord.	1	12*	12*	3 1/16	—	3 12 6
HOME AND FOREIGN TRAMS, ETC.						
Anglo-Arg. Trams First Pref.	5	Nil	Nil	5/9	—	—
Do. do. 2nd Pref.	5	Nil	Nil	5/–	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	21½	—	—
British Electric Traction Df. Ord.	„	5	5	1575xd.	−50	—
Do. do. Pref. Ord.	„	8	8	174½	−3	4 10 2
Brazil Traction	100	—	30 cts.	18	−½	—
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	104½	—	4 15 8
Mexican Light Common	100	Nil	Nil	3½	—	—
Do. 1st Bonds	$500	5	5	47	—	—
Victoria Falls Ord.	1	20	12	73/9	−1/16	3 5 0
West Riding	1	5	6½	48/9	−1/16	2 13 3
MANUFACTURING COMPANIES.						
Aron Electricity Ord.	1	10	15	62/6	—	4 16 1
Assoc. Elec. Ord.	1	6	8	50/6	−1/6	3 3 6
Do. Pref.	1	8	8	39/6	—	4 1 0
Babcock & Wilcox	1	8	8	48/9	−1/16	3 5 7
British Aluminium Ord.	1	7½	7½	43/6	−9d.	3 9 0
British Insulated Ord.	1	15	20	6½	+½	3 5 0
Brush Ord.	Stock	Nil	Nil	40½	−2	—
Callender's	1	15	15	4¾	+⅛	3 3 1
Do. 6½% Pref.	1	6½	6½	32/6	—	4 0 0
Crompton Parkinson Ord.	5/–	—	12½	3½	−1/16	—
Do. 8% Pref.	1	8	8	2	—	4 0 0
Electric Construction	1	3½	7	42/6	—	3 5 9
Enfield Cable Ord.	1	25	25	5 3/16	−1/16	4 10 0
English Electric	1	Nil	Nil	26/–	—	—
Do. Do. Pref.	1	Nil	Nil	27/–	—	—
Ericsson Tel.	5/–	24	20*	55/–	—	1 16 4
Ever Ready	5/–	35	35	30/–	—	5 16 8
Ferranti Pref.	1	7	7	28/9	—	4 17 5
G.E.C. Pref.	1	6½	6½	34/–	—	3 16 4
Do. Ord.	1	10	15	91/–	−2/–	3 6 0
Henleys	1	30	30	8½	—	3 8 6
Do. 4½% Pref.	5	4	4½	5½	—	3 18 3
India-Rubber Preferred	1	5½	5½	1½	—	4 17 9
Johnson & Phillips	1	7½	10	47/6	−1/16	4 4 0
Lancashire Dynamo	1	5	10	3½	—	2 19 0
Siemens Ord.	1	4	6	35/–	+1/16	3 8 7
Telegraph Construction	£1	Nil	Nil	35/–	—	—

* Dividends are paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be numbered and abridged and all subsequent proceedings will be taken.

1935

583. "High-frequency transformer." Loewe Radio Co., Ltd. (Radioakt.-Ges. D. S. Loewe). February 8th, 1935.(456515.)

4037. "Electrical sound-transmission systems." A. D. Blumlein. February 7th, 1935. (456444.)

8421. "Television and like transmitting systems." E. L. C. White. March 18th, 1935. (456650.)

10394. "Coupling means for thermionic valve circuits." E. L. C. White. April 3rd, 1935. (456450.)

10759. "Noise suppression in radio receivers." E. K. Cole, Ltd., and G. Bradfield. April 8th, 1935. (456519.)

10968. "Lamps, searchlights, projectors and the like." A. G. Cooke. April 9th, 1935. (456520.)

11005. "Television and like systems." M. Bowman-Manifold. April 9th, 1935. (456651.)

11163. "Modulated carrier-wave transmitters." Marconi's Wireless Telegraph Co., Ltd., and W. T. Ditcham. April 10th, 1935. (456526.)

11269. "Means for screening high-frequency carrying electric conductors." E. Huber. April 11th, 1935. (Convention date not granted.) (456722.)

13444. "Vapour lamps." F. Prizeman. May 7th, 1935. (456580.)

13568. "Electric cables." Okonite Co. June 24th, 1934. (456659.)

13587. "Systems of control for electrically operated lifts." Express Lift Co., Ltd., and R. J. Stevens. May 8th, 1935. (456729.)

13603. "Lead-in arrangements for electric conductors." Porzellanfabrik Kahla and H. Handrek. May 8th, 1934. (456662.)

13773. "Electric connecting devices of the plug-and-socket type." F. W. Read and Union Radio Co., Ltd. May 10th, 1935. (456528.)

13795. "Electric-discharge devices." General Electric Co., Ltd., and N. L. Harris. May 10th, 1935. (456531.)

13801. "Electric radiators." Cliffdown Electrical Appliances, Ltd. (in liquidation) and J. E. L. Brice. May 10th, 1935. (456452.)

13860. "Electrical control circuits, particularly for television and the like." C. F. Chapter and Baird, Television Ltd. May 11th, 1935. (456582.)

13862. "Electric switches, bell pushes, socket couplings and the like." G. E. Crabtree, W. T. Elliott, E. Badham and R. W. Thornton (legal representatives of J. A. Crabtree, dec.). May 11th, 1935. (456665.)

13913. "Electrical energy transmission systems for transmitting television and like signals." Marconi's Wireless Telegraph Co., Ltd., and N. M. Rust. May 11th, 1935. (456584.)

13915. "Microphones and circuit arrangements incorporating the same." Marconi's Wireless Telegraph Co., Ltd., and N. M. Rust. May 11th, 1935. (456585.)

13916. "Variable inductances." Marconi's Wireless Telegraph Co., Ltd., and H. J. Craymer. May 11th, 1935. (456586.)

13980. "Production of magnetic cores." Associated Electric Laboratories, Inc. June 20th, 1934. (456739.)

14051. "Vacuum or gas or vapour apparatus for electric discharges." J. Ismay and J. Ismay & Sons, Ltd. May 13th, 1935. (456748.)

14054. "Telephone systems." Automotic Electric Co., Ltd., R. Taylor and G. T. Baker. May 13th, 1935. (456750.)

14145. "Fluorescent screens suitable for use in cathode-ray tubes." Marconi's Wireless Telegraph Co., Ltd. May 23rd, 1934. (456755.)

14157. "Protection of transformers of the oil-immersed type." T. F. Altham and Hackbridge Electric Construction Co., Ltd. May 14th, 1935. (456758.)

14162. "Telephone systems." Automatic Electric Co., Ltd. May 24th, 1934. (456759.)

14163. "Incandescent filament electric lamps." Siemens Electric Lamps & Supplies, Ltd., and J. N. Aldington. May 14th, 1935. (456760.)

14233. "Electric-discharge devices comprising luminescent materials." General Electric Co., Ltd., and J. T. Randall. May 15th, 1935. (456765.)

14239. "Earthing arrangements for electric apparatus." A. Reyrolle & Co., Ltd., H. Leyburn, C. H. W. Lackey and G. D. Clothier. May 15th, 1935. (Addition to 429503.) (456766.)

14260. "Automatic switches for use in telephone or like systems." Automatic Electric Co., Ltd., and R. N. Saxby. May 15th, 1935. (456767.)

14348. "Electrical measuring instruments." Elliott Bros. (London), Ltd., and H. D. Hawkes. May 16th, 1935. (456793.)

14406. "Two-way telephone transmission systems or repeaters." Standard Telephones & Cables, Ltd., and K. E. Latimer. May 16th, 1935. (456827.)

14411. "Magnetically operated amplifying and control system." A. S. Fitzgerald. July 23rd, 1934. (456828.)

14497. "Scanning oscillators for television and like systems." G. R. Tingley, D. W. Pugh and Baird Television, Ltd. May 17th, 1935. (456666.)

14499. "Brush holders for dynamo-electric machines." Electrolux, Ltd. May 18th, 1934. (456774.)

14500. "Electric radiators and like heating apparatus." W. S. Barrett and A. I. Kemp. May 17th, 1935. (456775.)

14514. "Cathodes for gas or vapour-filled electron-discharge tubes." Elin Akt.-Ges. für Elektrische Industrie. December 22nd, 1934. (456776.)

14955. "Electric water-heaters." H. H. Berry. May 22nd, 1935. (456455.)

17942. "Electric fires or radiators." H. Frost & Co., Ltd., and A. W. Moss. June 22nd, 1935. (Cognate application 34445/35.) (456461.)

19376. "Electro-magnetic brakes." Laurence, Scott & Electromotors, Ltd., and W. D. Torry. July 6th, 1935. (456678.)

20393. "Windings for stationary electrical inductive apparatus such as transformers and reactors." A. G. Ellis and Metropolitan-Vickers Electrical Co., Ltd. July 17th, 1935. (456464.)

22769. "Thermal time-delay arrangements for electric circuits." Siemens Bros. & Co., Ltd., and W. R. Bloxsidge. August 13th, 1935. (456469.)

23286. "High-voltage electric condensers." F. S. Edwards and Metropolitan-Vickers Electrical Co., Ltd. August 19th, 1935. (456685.)

24877. "Electric-discharge devices." General Electric Co., Ltd. (Patent-Treuhand-Ges. für Elektrische Glühlampen). September 6th, 1935. (456608.)

27215. "Gas and vapour-filled electric-discharge devices." General Electric Co., Ltd. (Patent-Treuhand-Ges. für Elektrische Glühlampen). October 2nd, 1935. (Cognate application 33802/35.) (456613.)

27958. "Illuminated structures, signs and the like." W. G. Williams and Commercial Electric Co., Ltd. October 10, 1935. (456784.)

31906. "Production of incandescent electric lamp bases." J. R. de Fleury. November 18th, 1935. (456729.)

33885. "Fluorescent layers." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. February 5th, 1935. (456480.)

34543. "Electrical condensers." Hydrawerk Akt.-Ges. March 29th, 1935. (456618.)

1936

212. "Electric-discharge apparatus." W. Lehmann. January 2nd, 1935. (Cognate applications 213/36, 214/36 and 215/36.) (456482.)

1323. "Electrical apparatus for automatically controlling a variable." British Thomson-Houston Co., Ltd. January 16th, 1935. (456795.)

3654. "Electrical switches of the selector type." Cinch Manufacturing Corporation. February 19th, 1935. (456625.)

5115. "Electric door locks." W. C. Davey. February 20th, 1936. (Cognate application 12638/36.) (456801.)

5392. "Electric lighting installations." British Thomson-Houston Co., Ltd. February 23rd, 1935. (456803.)

5563. "Cathode-ray tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. May 29th, 1935. (456629.)

5778. "Windings for electric motors and other dynamo-electric machines." Siemens-Schuckertwerke Akt.-Ges. March 2nd, 1935. (456630.)

6256. "Fluorescent material." Farnsworth Television, Inc. March 13th, 1935. (456561.)

7303. "Electric propulsion systems for ships." H. N. Crook and F. E. Rebbeck. March 11th, 1936. (456488.)

7774. "Induction-type electric instruments and meters." Westinghouse Electric & Manufacturing Co. March 23rd, 1935. (456491.)

8605. "Production of pictures by means of electric charges." Egyesult Izzolampa es Villamossagi Reszvenytarsasag. March 22nd, 1935. (Addition to 9006/35.) (456810.)

9087. "Television systems." Marconi's Wireless Telegraph Co., Ltd. March 26th, 1935. (456564.)

9710. "Television and like systems." W. S. Percival and M. Bowman-Manifold. April 9th, 1935. (Divided out of 456651.) (Cognate application 13733/35.) (456709.)

10973. "Switching devices for glow lamps." Klangfilm Ges. April 17th, 1935. (456711.)

14109. "Scanning oscillators for television and like systems." G. R. Tingley, D. W. Pugh and Baird Television, Ltd. May 17th, 1935. (Divided out of 456666.) (456640.)

15800. "High-pressure mercury-vapour discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. August 31st, 1935. (456642.)

17566. "Apparatus for producing electrical tubular heating bodies." Siemens-Schuckertwerke. June 29th, 1935. (456647.)

17813. "Magnetic sound-recording apparatus." British Thomson-Houston Co., Ltd. June 26th, 1936. (456573.)

19403. "Electric bridge modulators." Siemens & Halske Akt.-Ges. July 13th, 1935. (456574.)

20255. "Arc welders." C. H. Benn and C. L. Benn. July 22nd, 1936. (Addition to 437213.) (456511.)

25753. "Braun tubes and circuits therefor, preferably for television purposes." Radioakt.-Ges. D. S. Loewe. March 31st, 1934. (Addition to 423427.) (Divided out of 6689/35.) (456717.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from December 2nd, 1936:—

Supermagnidyne. No. 570668. Class 8. Wireless receiving sets and parts thereof.—Kolster-Brandes, Ltd., Cray Works, Sidcup, Kent.

Decel (lettering and design). No. 572173. Class 8. Electric cables.—Durham Cables, Ltd., Birtley, County Durham.

Celto (lettering and design). No. 572197. Class 13. Electrodes and welding rods of ordinary metal.—The Quasi-Arc Co., Ltd., Woodland Road, Spotland, Rochdale, Lancs.

Cost of Electrical Installations

Addressing members of the newly formed Dumfries Electrical Society recently, Mr. D. S. Munro stated that the annual outlay on new electrical installations was now approximately £50,000,000, and this was a fraction of what would be expended when grid tariffs were more favourable. In his opinion the best electrical installation work in the world was done in Scotland, where the combination of great tube works and excellent iron foundries facilitated the earlier development of the modern steel conduit system. Architects were now alive to the need for co-operation with the electrical engineer throughout all the stages of building work. Costs in up-to-date new buildings for installations adequate for decoration, illumination, ventilation, heating, radio, private telephone, &c., were in the vicinity of 15 per cent. Mr. J. S. Pickles, burgh electrical engineer, presided.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Abbots Langley (HERTFORDSHIRE).—Factory, Ridgehurst estate, for Linson, Ltd.

Acock's Green (BIRMINGHAM).—Factory, for the Rover Car Co., Hay Hall Road, Tyseley, Birmingham (£60,000).

Aldridge (STAFFORDSHIRE).—Houses (36); U.D.C. surveyor.

Amblecote.—Cinema, for Leon Salberg and Capt. S. W. Clift.

Berkshire.—School, Botley, for County E.C.; W. F. Herbert, secretary, Shire Hall, Reading.

Birmingham.—Houses (100), Quinton estate; Purdon & Rees, 36, Great Russell Street, London, W.C.1. Cinema, King's Heath; Odeon Theatres, Ltd. Factory, Bagot Street, Aston; Wm. Sapcote & Sons, builders, Camden Street, Birmingham. Dwellings (99), Bankside Road (£42,596), and school, Stonehouse Farm estate (£28,350); city engineer.

Blackburn.—Houses (32), Coldstream Place, for R. Bennett.

Bradford.—Houses (54), White Abbey Road (£21,000); city architect.

Brighton.—Wing to the Royal Sussex Memorial Hospital (£25,000); Lord Decies, chairman of the Harry Preston Memorial Fund.

Bromley.—Houses (50), Bromley Manor estate, Hayes, for William & Phillips, Ltd. Houses (27), New Street Hill, for R. T. Read.

Carlisle.—Houses (36), Blunt Street; J. & R. Bell, Ltd. Fire station, Rickersgate (£60,767); city engineer. School, Compton Street, for E.C.

Chelmsford.—Houses (76), Great Baddow; A. E. Wiseman, architect, 10, Duke Street.

Cheltenham.—Houses (73), Cleeve Mount estate; G. A. M. Hall. Houses (24), Painswick Road, Badgeworth; Baldwin & Bishop. Development of Springfields estate, Little Witcombe; L. W. Nott.

Chesterfield.—Houses, Broomhall Park estate; W. A. Derbyshire, architect.

Cirencester.—Air station, South Cerney (£350,000); W. E. Chivers & Sons, Ltd., builders, Devizes.

Coventry.—Cinema and shops, Radford, for the Philpot Circuit (£70,000); Philpot Bros., builders, Much Park Street, Coventry. Shops, offices and showrooms, Trinity Street, for Coventry Developments, Ltd., 35, Curzon Street, London, W.1.

Dawley (SHROPSHIRE).—Cinema, King Street, for Town Hall Cinema Co., Ltd., Wellington, Shropshire.

Dodworth (YORKSHIRE).—Houses (77); H. Strutt, U.D.C. surveyor.

Edinburgh.—Houses (132); MacTaggart & Mickel, Ltd., 65, Bath Street, Glasgow. Houses (126), Learmouth Avenue; Learmouth Property Co., Ltd., 9, North David Street.

Ewell (SURREY).—Church, London Road, for the Congregational trustees; F. Lawrence, architect, Southborne, Bournemouth.

Falmouth (CORNWALL).—Houses (144); H. E. Tresidder, borough surveyor.

Faversham.—Schools, the Mall, for Borough E.C.; director of education.

Flaxton.—Houses (20), Carlton estate, Hull Road; E. Sherrey.

Glasgow.—Houses (21), Paisley Road West; J. Y. Keanie, Ltd., Floors Street, Johnstone, Renfrewshire. Large block of showrooms, Bridge Street; Cowieson's, Ltd., Charles Street. Palais de Danse, Hillfoot Street; C. J. McNair and Elder, architects, 272, St. Vincent Street. School for Corporation Education Department, Auckland Street; Weddel and Inglis, architects, 216, Bath Street.

Great Yarmouth.—School (320 places), for Borough E.C.; Olley & Haward, architects, Queen Street.

Guisborough.—Houses (38); R. H. Kilburn, U.D.C. surveyor, Council Offices.

Halesowen.—Houses (66), Cradley; W. J. Tolley, builder.

Halstead (ESSEX).—Houses (72); R.D.C. surveyor.

Haslingden (LANCASHIRE).—Houses (41); borough surveyor.

Haydock.—Houses (130); U.D.C. surveyor.

Hertfordshire.—School, Grosvenor Avenue, Barnet, for County E.C.; county architect, Hatfield.

Hurstpierpoint (SUSSEX).—Re-erection of motor engineering works, High Street, for Hurst Motor Engineering Co.

Ilkeston.—Houses (40), near Corporation Road; Charnos Hosiery Co., Ltd.

Lancashire.—School, Rainford, Brook Lodge estate, Higher Lane, for County E.C.; S. Wilkinson, county architect, County Offices, Preston.

Leeds.—Shops and houses, Gledhow Road and Roundhay Road; R. Battersby & Sons.

Lincolnshire.—Technical institute (£70,000); Gainsborough, for County E.C.; director of education, Lincoln.

London.—(EAST HAM).—Baths, Romford Road (£30,000); borough engineer. (FULHAM).—Flats (90), St. James's Home site (£62,510); borough engineer. (STEPNEY).—Houses, James Street area (£46,000); L.C.C. architect.

Luton.—School, Beechwood (£23,290), for the Borough E.C.; H. C. Janes, Ltd., builders. Houses (76), Leagrave; borough surveyor. Cinema, Castle Street, for K. MacLaglen.

Manchester.—Houses (589) and shops, Littleton Road, near Kersal Moor; A. Cassel & Sons, builders, 300, Great Cheetham Street, Salford, 7.

Market Harborough.—Development of Bowden Fields estate; Coales & Green.

Mottingham.—Houses (1,058) and flats, L.C.C. estate (£413,236); Wilson, Lovatt & Sons, Ltd.

Newcastle-on-Tyne.—Cinema, Fergusons Lane, for T. H. Smelt; S. J. Stephenson & Gillis, architects, 2, Saville Place.

Northampton.—Houses (20), Bushland Road; A. Glenn & Sons, Ltd. Houses (128), Longland estate; T. Wilson & Son, Ltd.

North Shields.—Block of 135 flats, for the Sir James Knott Memorial Trust; A. K. Tasker, Trinity Buildings, New Bridge Street, Newcastle-on-Tyne.

Norton (YORKSHIRE).—Houses (64); W. M. Jackson, architect, Normanton.

Oldbury.—Engineering factory, Seven Stars Road; H. Robinson.

Penistone (YORKSHIRE).—Houses (40); R.D.C. surveyor.

Plymouth.—Houses (77), Merryvale Road, Swilly; F. Westacott. Conversion of Stoke Military hospital into schools (£75,368); Pearn Bros., Ltd. Dwellings (719), various estates; city engineer.

Portsmouth.—Covered car park, Swan Street; Portsmouth Builders Guild. Flats (36), Cumberland Street (£19,202); W. H. Hillier. Rebuilding premises, London Road; Bovis, Ltd.

Rawtenstall.—Houses, Hall Carr estate, Tuff Pit Barn Farm, Crawshawbooth and Waterfoot; J. Johnson, borough surveyor, Town Hall.

Reading.—Houses (108); housing architect.

Richmond (YORKSHIRE).—Cinema; George Dougill & Son, Ltd., builders, Darlington.

Rochdale.—School, Brimrod (£22,615), for E.C.

Rochester.—Houses (120), Delce Farm estate, for Wigram, Ltd.

Rugby.—Municipal buildings; E. Prestwich, architect, Leigh, Lancashire.

Sandwich.—Cinema; A. Burr, architect, Gower Street, London, W.C.2.

Sanquhar.—Houses (30), Renwick Place, electrical work; burgh surveyor.

Sheffield.—Factory, Penistone Road, for Hack Saws, Ltd., Aven works, Capel Street; A. Nunweek, architect, Mazda Buildings, Campo Lane.

South Shields.—Isolation hospital, Cleadon (£42,000), and sports stadium (£21,500); J. Reid, borough engineer.

Southend-on-Sea.—Children's homes, Shoeburyness; borough engineer.

Stockton-on-Tees.—Municipal buildings; borough engineer.

Stoke-on-Trent.—Houses (152), Eaves Lane, Bucknall; G. & J. Seddon, Ltd., builders, Sandon Road, Longton.

Stretford.—Extensions to works, Skerton Road; W. J. Brookes & Sons, Ltd.

Surrey.—Extensions to Mental hospital, Brookwood (£80,000); county architect.

Swindon.—Houses (74), Bessemer Road; E. W. Beard, Ltd. Houses (135), Burford Avenue, &c.; Colbornes Estates, Ltd. Houses (166), Churchward Avenue, &c.; E. H. Bradley & Sons.

Tonbridge.—Houses (56); W. N. Miller, R.D.C. surveyor, 48, Pembury Road.

Trowbridge.—Theatre for Gaumont-British Picture Corporation, Ltd.; W. E. Trent, architect, Hermon Hill, London, E.18.

Tyseley.—Factory, Redfern Road, for C. H. Hare & Son, Ltd., Crown works, King's Road.

Wallsend-on-Tyne.—Houses, near North Road; R. A. Gofton & Sons, builders, Pykerley Road, Monkseaton.

Wembley.—Factory, for the Glacier Metal Co., Ltd., Alperton.

West Ashford (KENT).—Houses (52); R.D.C. surveyor.

West Bromwich.—Cabinet factory, Roebuck Lane; Aston Cabinet Co., Ltd.

Willenhall.—Public baths and hall (£18,000); U.D.C. surveyor.

Winchester.—Houses (32); W. R. Cowell, R.D.C. surveyor, Ryelands, Hedge End, near Southampton.

Wittersham (KENT).—Houses (311), hotel, cinema, &c., The Stocks, for Scott Developments, Ltd.

Worcester.—Houses (126), Tolladine Road estate; city engineer, Guildhall.

Wrexham.—Houses, Whitegate Farm estate (18-acre site); borough surveyor.

York.—Houses (128) and flats, Water Lane estate; C. J. Minter, city engineer, Guildhall.

Yorkshire.—Electric lighting installation, Wickersley new school, for West Riding E.C.; Education Officer, Wakefield. School, Bayton Lane, Yeadon, West Riding; H. Wormald, county architect, County Hall, Wakefield. School, Queensbury, for West Riding E.C.; director of education, Wakefield.

Wavelengths of Electron Oscillations

Among the papers submitted recently to the PHYSICAL SOCIETY in London was one in which Mr. R. Cockburn explains how it has been confirmed experimentally that with a retarding field triode valve electron oscillations can be maintained whose wavelengths are determined completely by the external circuit (Gill-Morell oscillations) and that, in addition, oscillations can be obtained with wavelengths completely independent of the external circuit, provided the latter does not approach resonance with them (Barkhausen-Kurz oscillations). The dependence of the last-mentioned type of oscillations on the valve dimensions and operating conditions is examined in detail. For any given set of conditions there are not one, but two possible fundamental wavelengths, both of which may give harmonics. The shorter oscillations are due to the periodic transit of electrons between the cathode and virtual cathode. The longer oscillations are not due to any such transit of electrons, but are determined by the resonant circuit formed by the grid-plate capacity in parallel with the equivalent inductance of the electron cloud between these electrodes.